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Original Articles

Reversal of Biochemical Processes in Cases of Cochlear and Vestibular Dysfunction

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NEW YORK

MEDICAL science advances not so much by the discovery of previously unknown facts as by the logical coordination of facts and factors that may be either old or entirely new. When the logically coordinated application of either old or newly discovered factors is found to fill an existing gap in scientific knowledge, it usually becomes evident that some unsolved problem in clinical practice has advanced toward solution.

In this study of deafness and vertigo a series of clinical cases is described, with particular stress on the biochemical blood values as indicators of biochemical physiologic dysfunction. It is proposed to demonstrate how hypercholesterolemia and hyperpyruvemia hold the key to comprehension of the factors at fault in dysfunction of the cochlear and vestibular mechanisms. The same observations will show how, in the case of very young infants, these factors fill the gap in professional knowledge concerning the development of the hereditary factor in congenital deafness (deafmutism), and they will also afford a logical explanation as to how the hereditary factor is so activated as to result in deafness in children of school age who have survived a severe systemic illness. This type of deafness is usually brought to attention by school authorities and, subsequently, by otologic examinations.

At the present stage of knowledge, the known and generally accepted concepts may be sketched as follows:

1. *The anatomic concept of the diverse distribution of nerve fibers of the sympathetic and parasympathetic divisions of the autonomic nervous system.* With regard to the problems that concern this presentation, the autonomic nerve connections that partly control the functions of the pituitary gland (and also, to some extent, the functions of the thyroid and parathyroid glands and those of the thoracic and abdominal viscera and the endocrine glands) are to be noted.

As regards vertigo particularly, the nerve tracts from the skeletal musculature and from the vestibular portion of the inner ear, run-

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ning centrally to coordinating centers in the cerebellum and from there to the thalamus (the area of unconscious cerebration) to cortical cerebral centers, also contribute known anatomic items for consideration.

2. *The physiologic concept of the neuroglandular mechanisms of the hypophysis, particularly those of the anterior lobe of the pituitary gland and the nervous structures of the hypothalamus.* This area[1] contains centers regulating vital and fundamental processes; e.g., the metabolism of carbohydrates, fats and water. In the hypothalamus and its tubal area are located centers that govern the autonomic nervous system. Physiologists believe that these constitute a parasympathetic center. In the posterior portion of the gland are situated cells that are held to exert a directing influence over the sympathetic nervous system. The interplay of the parasympathetic and sympathetic neuromechanisms results at the respective nerve terminals either in a cholinergic or in an adrenergic effect.

3. *The well known and generally accepted concept of the biochemical mechanisms* involved in oxygen uptake in the essential steps of phosphorylation in the metabolism of carbohydrate, and protein bonds in the various stages of the metabolism of fats and lipoids.

4. *The clinical concept of the part played by the Mendelian law in the heredity of deafness.* There are authentic records of families in which deafness apparently is a family heritage. Likewise, there are authentic case records of persons with such a heritage in which there is evidence that after a severe systemic bacterial infection, immediately after the onset of puberty, during pregnancy (especially the second pregnancy) or after the onset of the menopause in women or its analogue in men, dysfunctions in the cochlear and vestibular mechanisms become clinical entities.

5. *The pathologic concepts through which physicians have generally accepted knowledge* of the long list of diseases, particularly arteriosclerosis, and also most of the so-called deficiency diseases—von Recklinghausen's disease, rickets, Paget's disease, osteoporosis, osteodystrophia fibrosa, chondrodystrophy, osteogenesis imperfecta and otosclerosis[2]—in which osseous pathologic change at the otic capsule has been demonstrated. Dwarfism and other endocrinopathic conditions also are associated with large numbers of osseous lesions, both in the skeletal bones and in the otic capsule. By and large, the endocrinopathies affect the pituitary gland, the thyroid gland and the parathyroid glands. The adrenal and the gonadal glands may also be involved.[3]

The foregoing five paragraphs outline the most important known factors with which this study is concerned. To these may be added the more recently acquired knowledge of the physiologic activities of the various enzymes and co-enzymes, and of their synthesis and disintegration under the interplay of traumatic antagonistic sympathetic and parasympathetic activity, including the role played by vitamins and hormones. If these reactions and their results are correlated with the results of laboratory experiments performed on animals fed avitamized diets,[4] an existing gap in knowledge is apparent. The clinical problems inherent in deafness remain unsolved.

When the physiologic nature of the enzymatic processes and their relations to function and dysfunction in the cochlear and vestibular systems were first comprehended, the circulating blood was thought to contain not only an index to the status of the enzymatic mechanism but a measure that might be used in prognosis with regard to the abnormalities presented by the defective enzymatic process.

A study of the biochemical blood values in cases of deafness was therefore undertaken. The information obtained from pathologic values in 581 cases appears to bridge a gap in professional knowledge as to how and why the cochlear and vestibular dysfunction occurs, by indicating a biochemical pathologic condition of the blood. It also indicates a means by which the therapist can prevent further deterioration of cochlear and vestibular function by causing a reversal of the chemical processes. Furthermore, as the cases to be presented will demonstrate, in many instances it offers a means of improving the physiologic activity of the mechanisms concerned in the acoustic and equilibrial dysfunctions presented by the patient, resulting in better hearing acuity and a more stable equilibrium.

Figure 1 represents a general summation of the cases described in this study.

Obviously, in a series of 581 case studies, in

461 of which biochemical examinations of the blood were made, it is impossible to present a major number of the cases in detail. Besides, statistical reports have little scientific value in the case of any given patient, because it is absolutely impossible to predict that the particular patient will or will not respond to the promulgated therapy. This is because so many causes far beyond the scope of the cochlear and vestibular mechanisms contribute the actual factors at fault in the specific dysfunctions presented. Although it is not necessarily true in every instance, in many such cases there results an analogous clinical picture of deafness and vertigo. The symptoms of dysfunction of the cochlear and vestibular apparatus here occur as secondary effects of the defective chemical processes inherent in the primary disease.

A summation, therefore, of the total number of deafened patients submitted to therapy and of the number improved, unimproved or worse is of no scientific value. Such a compilation would involve unlike conditions, because the spread of enzymatic dysfunction covers too wide a physical field to be put into exactly and scientifically defined groups. It must also be understood that for physiologic function there is a relation between sets of cholinergic and adrenergic biochemical processes, so that when one set is in a state of imbalance the others do not function at the optimal physiologic level. This also creates differences that cannot be compared. In other words, deafness and vertigo arise from sources that are often not in direct relation to the ear and its functions. A few examples may be cited.

Case 1: H. F., who suffered from an undiagnosed, largely asymptomatic carcinoma of the stomach, presented a set of predominant symptoms including deafness, severe tinnitus and vertigo. The gastric cancer induced the dysfunction, which resulted in the demonstration of hypercholesterolemia and hyperpyruvemia on chemical examination of the blood.* At first the patient presented no symptoms

*Strangely enough, hypercholesterolemia and hyperpyruvemia are also present in the patients afflicted with malignant disease. In fact, biochemical examination of malignant tissue shows pyruvic/lactic acid present, denoting a lack of oxygen uptake. No malignancy having been suspected, the blood values were considered only as they affected the cochlear and vestibulary mechanisms.

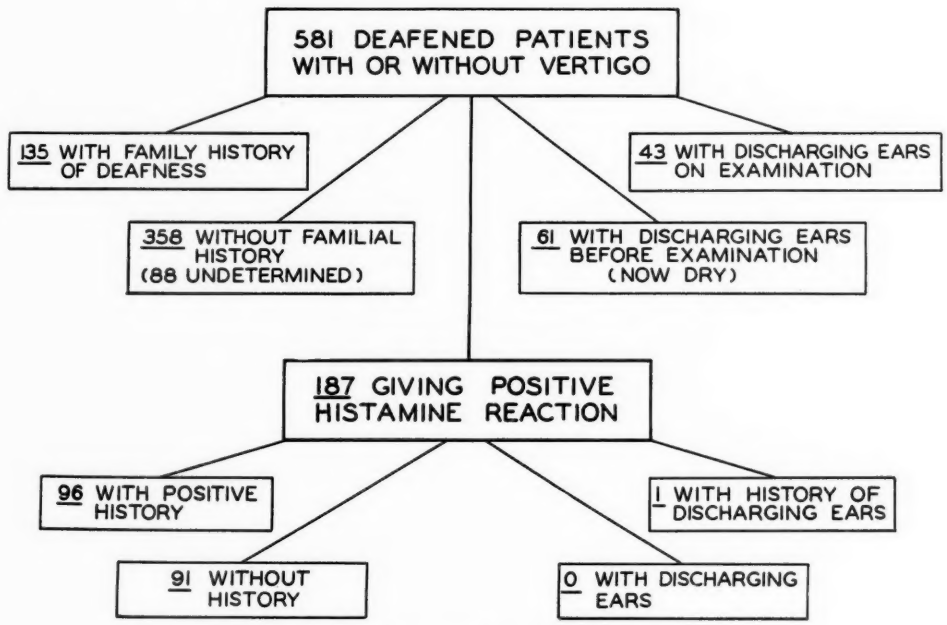
581 DEAFENED PATIENTS WITH OR WITHOUT VERTIGO
135 WITH FAMILY HISTORY OF DEAFNESS
43 WITH DISCHARGING EARS ON EXAMINATION
358 WITHOUT FAMILIAL HISTORY (88 UNDETERMINED)
61 WITH DISCHARGING EARS BEFORE EXAMINATION (NOW DRY)
187 GIVING POSITIVE HISTAMINE REACTION
96 WITH POSITIVE HISTORY
1 WITH HISTORY OF DISCHARGING EARS
91 WITHOUT HISTORY
0 WITH DISCHARGING EARS

Fig. 1.—Diagram of study presented in this paper.

TABLE 1.—*Hearing Losses in Case 1*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
7/9/46	38	53	36	44	35.4	Mobile	Mobile
9/6/46	40	46	35	40	31.9	Mobile	Mobile
10/17/46	41	51	36	41	36.5	Mobile	Mobile
12/10/46	40	50	33	40	31.5**	Mobile	Mobile
1/22/47	42	51	37	44	41.0	Mobile	Mobile
3/19/47	40	50	33	43	33.7	Mobile	Mobile
4/23/47	41	50	34	43	35.8	Mobile	Mobile
6/4/47	41	48	34	42	34.8	Mobile	Mobile
9/1/47	42	49	33	44	34	Mobile	Mobile

**Tinnitus considerably lessened. This was the maximum gain; thereafter the patient showed rapid loss of weight and general deterioration, followed by death due to cancer.

TABLE 2.—*Biochemical Hematologic Values in Case 1*

Constituent*	Normal value	Value in Case 1 7/17/46	Value in Case 1 10/18/46	Value in Case 1 12/5/46	Value in Case 1 1/22/47
WB—Urea N	12–15	12.6	18.0	14.7	14.3
WB—Uric acid	2.5–3.5	1.3	2.55	2.4	2.3
WB—Sugar	80–120	85.0	75.0	95.0	100.2
BS—Cholesterol	160–200	222.5	250.0	305.0	305.0
BS—Phosphorus					
BS—Calcium	9–11	9.4	11.0	10.0	9.6
BS—Carotene	115–122	128.2	125.0	122.4	124.1
BS—Vitamin A	70–197	89.6	101.5	85.4	110.1
BP—Vitamin B_1	0.6	0.906	0.816	0.776	0.986
BP—Vitamin C	0.8–2.4	1.41	1.11	1.64	1.73
BS—Total protein %	6.5–8.2	7.18	6.24	7.26	7.5
BS—Albumin %	4.6–6.7	5.10	4.80	4.99	5.8
BS—Globulin %	1.2–2.3	2.08	1.44	1.25	1.7

*In this and in all succeeding tables, of hematologic values, the abbreviations used are as follows: Urea N, urea nitrogen; WB, whole blood; BS, blood serum; BP, blood plasma.

except those concerned with the cochlear and vestibular mechanisms. These symptoms were so marked that the patient had been hospitalized for a checkup study to establish or rule out the presence of a tumor of the pontine angle. No such tumor was found, and the patient came under my observation.

The hearing losses are shown in Table 1. The hearing improved during the first five months of treatment. Thereafter deterioration set in, with rapid loss of weight and symptoms referable to the gastrointestinal tract. An exploratory laparotomy was done, and carcinoma of the stomach was discovered. The patient survived operation but died of the malignant neoplasm within a few months. It is interesting to note the results of successive biochemical examinations of the blood (Table 2).

The gastric cancer defeated therapy based upon efforts to correct the biochemical blood values as they were on July 17, 1946, at which time hypercholesterolemia and hyperpyruvemia were evident. The progressive evolution of the malignant tumor in the gastrointestinal tract impaired the intermediate carbohydrate metabolism in its phosphorylation mechanism. As may be noted from Table 2, successive studies of the blood demonstrated an increase of the hypercholesterolemia despite therapy. The increased hypercholesterolemia coincided with

TABLE 3.—*Hearing Losses in Case 2*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
1/24/49	23	21	12	11	2.2	Mobile	Mobile
4/1/49	19	20	9	12	2.1	Mobile	Mobile
5/9/49	19	22	9	15	2.0	Mobile	Mobile
6/6/49	17	19	9	12	1.6	Mobile	Mobile
7/6/49	15	17	8	11	1.0	Mobile	Mobile

increases in hearing loss (Table 2). There was also a deficiency in the diphosphothiamine-magnesium-protein item of the vitamin B group, as indicated by the presence of hyperpyruvemia.

The cochlear and vestibular symptoms were the result of these faulty enzymatic systems' dysfunction—they were actually a secondary effect. As long as the enzymatic dysfunction persisted because of the malignant neoplasm, no therapy was available to effect a reversal of the biochemical processes. It must be obvious that such a case and the therapy applied therein should not be classified with cases of cochlear and vestibular dysfunction due to otosclerosis.

Case 2: M. D., aged 38, consulted me for an annoying tinnitus that kept him from sleeping. His clinical history revealed that he had had severe hypertension with blood pressure readings of 220 systolic and 130 diastolic, for relief of which he had undergone sympathectomy one year previously. This patient was *totally unconscious* of any hearing loss. There was no history of familial deafness, no prolonged bone conduction, and no lifting of the lower tone limit in either ear. The ossicular chains were mobile. The hearing losses are summarized in Table 3.

There have been distinct improvements in this patient's hearing. The biochemical blood values are shown in Table 4. Here too, the deafness, which *resulted from factors due to arteriosclerosis*, is an argument against putting all cases in one category.[5]

In this case the deafness was not of long duration. Hearing loss was above the level of 30 decibels; hence the patient's unawareness of his hearing disability is comprehensible. His prompt response to therapy also bespeaks the recent onset of cochlear functional deterioration. Sympathectomy relieved his vascular tension and eased his cardiac function, but the general vascular disease that brought about quantitative changes in the wonted physiologic metabolism of fats (being in this case, as in most such cases of vascular disease, a metabolic dysfunction incidental to faulty carbohydrate metabolism) *needed medical therapy specifically aimed to cause a reversal of the chemical processes* and bring the faulty carbohydrate metabolism to a halt. In this case, with both hypercholesterolemia and hyperpyruvemia present, the improved hearing acuity demonstrated by audiometric tests and tuning fork tests indicates that the reversal is being accomplished.

Case 3: M. D., aged 43, had noted loss of hearing for one year; there was no tinnitus and no familial history of deafness. The patient had diabetes and alleged that he had ulcers of the stomach. He did not remember any childhood illnesses. He had never had discharging ears. He had had but few colds and no dizzy spells.

TABLE 4.—*Biochemical Hematologic Values in Case 2*

Constituent	Normal value	Value in Case 2
WB—Urea N	12–15	15.9
WB—Uric acid	2.5–3.5	5.9
WB—Sugar	80–120	92.5
BS—Cholesterol	160–200	250.0
BS—Phosphorus	2.5–4.0	4.05
BS—Calcium	9–11	10.3
BS—Carotene	115–122	120.8
BS—Vitamin A	70–197	97.6
BP—Vitamin B_1	0.6	0.816
BP—Vitamin C	0.8–2.4	1.08
BS—Total protein	6.5–8.2	6.0
BS—Albumin %	4.6–6.7	4.1
BS—Globulin %	1.2–2.3	1.9

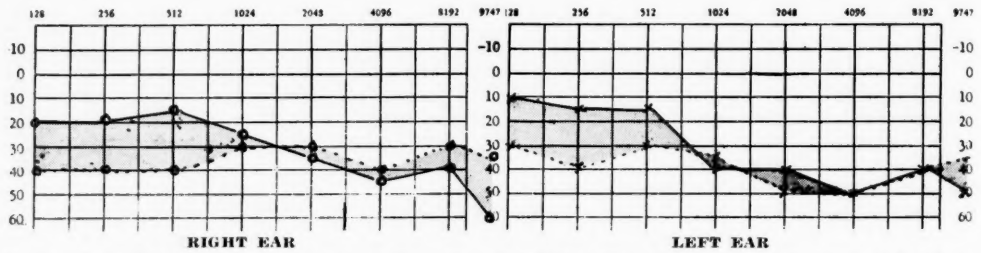

Fig. 2.—Case of M.D., aged 43, as observed from November 1948 to June 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 5.—*Hearing Losses in Case 3*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
11/8/48	29	28	20	25	21.7	Movable	Movable
2/18/49	24	26	16	24	20	Movable	Movable
6/24/49	32	34	27	31	24.8	Movable	Movable

Physical examination revealed a small spur at the left side of the nasal septum. The tonsils had been removed previously. The pharynx was clean. In the right ear, the whole drum and the ossicles were movable and the canal normal in diameter. The vascular reflex was slow, and the drum was slightly indurated. The left ear showed the same conditions. The results of audiometric hearing tests are charted in Figure 2 and summarized in Table 5. Bone conduction under conditions of masking gave responses only to the 512 and 1024 frequency bands. Fork tests showed shortened bone conduction in both ears and no prolonged bone conduction.

TABLE 6.—*Biochemical Hematologic Values in Case 3*

Constituent	Normal value	Value in Case 3
WB—Urea N	12–15	14.2
WB—Uric acid	2.5–3.5	3.7
WB—Sugar	80–120	177.5
BS—Cholesterol	160–200	290.0
BS—Phosphorus	2.5–4.0	2.04
BS—Calcium	9–11	10.95
BS—Carotene	115–122	119.8
BS—Vitamin A	70–197	96.0
BP—Vitamin B_1	0.6	0.8
BP—Vitamin C	0.8–2.4	1.5
BS—Total protein %	6.5–8.2	6.75
BS—Albumin %	4.6–6.7	4.74
BS—Globulin %	1.2–2.3	2.01

The results of biochemical examination of the blood are shown in Table 6.

The presence of hypercholesterolemia is significant, since the dysfunction in the mechanism of storage and delivery of sugars to the tissues is similar in some elements to the abnormality in carbohydrate utilization observed in the other cases in this group. Four different diseases and conditions are involved, but in each a dysfunction in metabolism produced a *secondary effect* on the cochlear and vestibular mechanisms, resulting in symptoms of deafness, tinnitus and vertigo.

Case 4: L. K., aged 14 years, had suffered a severe attack of mumps one year prior to examination. Since then the hearing in the left ear had deteriorated. There was also severe tinnitus, heard only in the left ear. There was a positive familial history of deafness, the patient's aunt (mother's sister) being deafened. The patient had never had a discharge from the ears.

Functional tests, both audiometric and by tuning fork, revealed a mixed type of deafness—perception and conduction type—with a raised lower tone limit above the 64 double vibration level in the left ear only. There was no prolonged bone conduction. An audiometric charting of the first test

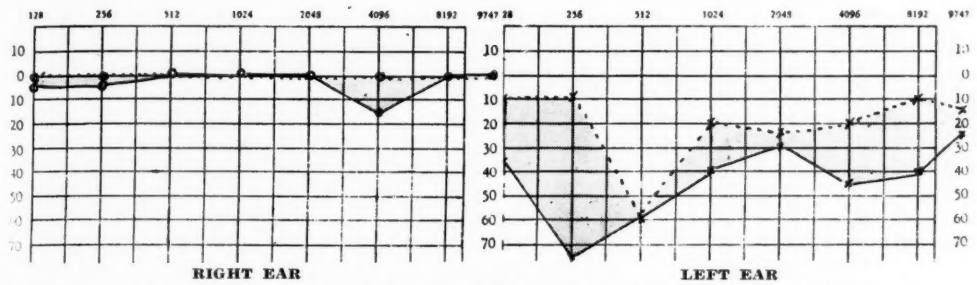

Fig. 3.—Case of L. K., aged 14, as observed from May 1943 to June 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

and one of the more recent tests is shown in Figure 3.

The blood chemical values are summarized in Table 7. A mild degree of hypercholesterolemia was present, with a marked degree of hyperpyruvemia. There was a low sugar content. An imbalance in the protein-albumin ratio was noted.

Toxins from the mumps had definitely attacked the eighth nerve. This was demonstrated by tuning fork tests and audiometric bone conduction tests under conditions of masking.

Medication aimed at reversal of the chemical processes at fault was effective, as Figure 3 indicates. One band of frequency cycles (that of 512 cycles per second) was the only one that failed to show improved function in response to the therapy, which was specifically aimed to reestablish control over the *cholinesterase factor at fault,* which handicapped the chemical mediator—the acetylcholine item necessary to convert the energy of a sound wave pattern at the end organ of the acoustic nerve and along its nerve pathways passing centrally, particularly at their various synapses.

From the 4 cases thus far cited it must be evident *that statistics based upon deafness and upon hearing loss in decibels,* handled as *one group* and submitted to either medical or surgical therapy, have no real scientific value, because it is impossible completely to define the various groups of conditions, diseases, sequelae of previous illnesses, etc., all of which have affected the cochlear and vestibular mechanisms.

Therefore, in what follows no attempt is made at a statistical summation of the results of the administered therapy upon deafness, upon tinnitus, or upon vertigo *per se,* because these are not diseases. They are symptoms arising from many diseases and conditions, including some of psychosomatic origin.

Case 5: H. E., a man aged 55, stated that every time he swallowed he had a sensation of "pull" in his ears, accompanied by tinnitus, which he described as a ringing sound. He had no dizzy spells, and there was no family history of deafness. He had never had hay fever. He had been given a special diet because of excessive weight in 1947 and had lost 20 pounds (9.1 Kg.) over a period of three years.

Physical examination revealed a very mild deflection of the nasal septum to the left and some degree of hypertrophic ethmoiditis. Tonsillectomy had been performed, but some tissue remained. There was granular pharyngitis. The drum of the right ear was slightly indurated. The vascular reflex was prompt. The canal was not enlarged, and the ossicular chain was mobile. Similar conditions prevailed in the left ear. Both eustachian tubes were patent. Tests for histamine sensitivity gave negative results. Table 8 sums up the data obtained on functional examination. The initial and latest audiographic results are charted in Figure 4.

TABLE 7.—*Biochemical Hematologic Values in Case 4*

Constituent	Normal value	Value in Case 4
WB—Urea N	12–15	13.0
WB—Uric acid	2.5–3.5	1.5
WB—Sugar	80–120	62.5
BS—Cholesterol	160–200	207.5
BS—Calcium	9–11	10.0
BS—Carotene	115–122	117.8
BS—Vitamin A	70–197	93.6
BP—Vitamin B_1	0.6	0.826
BP—Vitamin C	0.8–2.4	1.249
BS—Total protein %	6.5–8.2	7.8
BS—Albumin %	4.6–6.7	5.6
BS—Globulin %	1.2–2.3	2.2

TABLE 8.—*Hearing Losses in Case 5*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
6/10/48	43	38	28	30	34.9	Mobile	Mobile
7/30/48	32	29	20	17	25.3	Mobile	Mobile
9/ 3/48	28	26	15	16	16.7	Mobile	Mobile
10/ 9/48	25	24	15	16	17.0	Mobile	Mobile
11/ 1/48	20	24	12	16	11.7	Mobile	Mobile
12/13/48	19	23	11	15	11.4	Mobile	Mobile
2/21/49	17	23	9	11	10.7	Mobile	Mobile
7/ 8/49	16	20	9	11	10.7	Mobile	Mobile

TABLE 9.—*Biochemical Hematologic Values in Case 5*

Constituent	Normal value	Value in Case 5, June 1948	Value in Case 5, June 1949
WB—Urea N	12–15	16.7	16.7
WB—Uric acid	2.5–3.5	4.8	4.4
WB—Sugar	80–120	127.5	126
BS—Cholesterol	160–200	207.5	280.0
BS—Phosphorus	2.5–4.0	4.62	5.23
BS—Calcium	9–11	10.4	9.4
BS—Carotene	115–122	115	116.4
BS—Vitamin A	70–197	103.5	98.6
BP—Vitamin B_1	0.6	0.656	0.816
BP—Vitamin C	0.8–2.4	0.659	1.37
BS—Total protein	6.5–8.2	6.75	6.75
BS—Albumin %	4.6–6.7	5.25	3.95
BS—Globulin %	1.2–2.3	1.5	2.80

Bone conduction tests under conditions of masking revealed islands of nerve deafness in the frequency bands of 2048, 4096 and 8192 cycles per second.

The results of biochemical examination of the blood are shown in Table 9. They indicate a mild degree of hypercholesterolemia, and a slight excess of pyruvic acid was noted in the first examination. This prognosticated improvement if reversal of the chemical processes at fault were brought about by corrective therapy. The results justified this prognosis at the end of approximately one year. Recently, however (1949), the patient reported sensations of uneasiness in equilibrium. A second examination of the blood was undertaken, despite the excellent hearing results shown by functional hearing tests taken at the same time of the year. The second examination revealed, among other things, an increase in hypercholesterolemia and hyperpyruvemia. Changes in therapy have been instituted toward further reversal of the abnormal chemical processes.

Case 6 offers a contrast to those just reported.

Case 6: Mrs. L. M., aged 30, in August 1947 felt a sensation of fullness in both ears and had an attack of dizziness. She lay down and the sensation

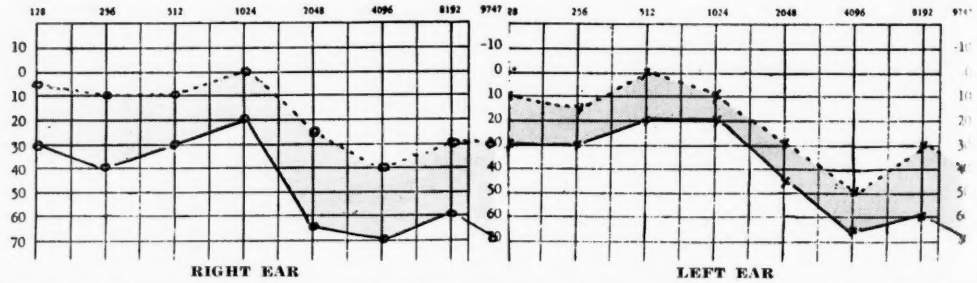

Fig. 4—Case of H. E., aged 55, as observed from June 1948 to July 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

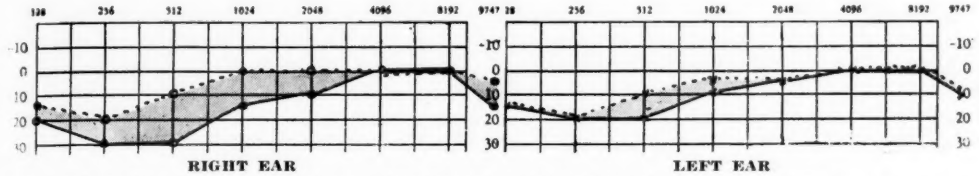

Fig. 5.—Case of L. M., aged 30, as observed from December 1941 to September 1948. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 10.—*Hearing Losses in Case 6*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
12/ 6/47	13 4/8	9 1/8	15	9	1.6	Movable	Impeded Motion
1/20/48	12 5/8	9 6/8	13	9	1.6	Movable	Impeded Motion
3/14/48	13	11	12	10	1.1	Movable	Impeded Motion
6/16/48	12 4/8	8 6/8	9	8	0.8	Movable	Impeded Motion
7/ 7/48	12 1/8	8 1/4	10	6	0.6	Movable	Impeded Motion
9/17/48	5 4/8	7 6/8	2	4		Movable	Impeded Motion

passed. She visited her physician, who gave her hormone pills.

The attack had come on just before her menstrual period. She was under treatment by inflation of the eustachian tubes. When I examined her the feeling of fullness had gone. She was not conscious of any deafness. She complained of a feeling of dizziness, somewhat less severe during the week that had just passed.

She was the mother of one child. She had had no miscarriages and no abortions. Her father was deafened as a result of infection. At the age of 6 years the patient had had an abscess in the right ear, but no otic trouble thereafter.

Physical examination revealed the nose to be normal. In the right tonsil bed there were some tabs of tissue. Cerumen was present in the left ear. The posterior portion of the drum was most movable. The drum was conical; the umbo of the malleus seemed drawn sharply inward, at an angle of 45 degrees to the horizontal position. The vascular reflex was absent, and the ossicles were impeded in motion.

The right ear showed an atrophic spot between 5 and 6 o'clock on the drum, resembling a healed perforation. The ossicles were movable. The vascular reflex was much retarded. The umbo was bound down against the promontory (conical position). There was scar tissue around the eustachian tube at the pharyngeal orifice. Both eustachian tubes were patent.

TABLE 11.—*Biochemical Hematologic Values in Case 6*

Constituent	Normal value	Value in Case 6
WB—Urea N	12–15	12.5
WB—Uric acid	2.5–3.5	2.0
WB—Sugar	80–120	95.3
BS—Cholesterol	160–200	187.0
BS—Phosphorus	2.5–4.0	2.6
BS—Calcium	9–11	9.9
BS—Carotene	115–122	116.9
BS—Vitamin A	70–197	106.9
BP—Vitamin B_1	0.6	0.856
BP—Vitamin C	0.8–2.4	2.1
BS—Total protein	6.5–8.2	7.8
BS—Albumin %	4.6–6.7	5.9
BS—Globulin %	1.2–2.3	1.9

A summary of the results of functional tests is given in Table 10. Tuning fork tests showed no prolonged bone conduction and no raised lower tone limit above 64 double vibrations.

Table 11 shows the results of biochemical examination of the blood. No hypercholesterolemia was evident; therefore the prognosis was good as to the improvement of hearing acuity if the dysfunction at the cochlear nerve ends were relieved by supplying the deficiency in the diphospho-thiamine-magnesium-protein item of the Vitamin B group. The hearing results justified this prognosis.

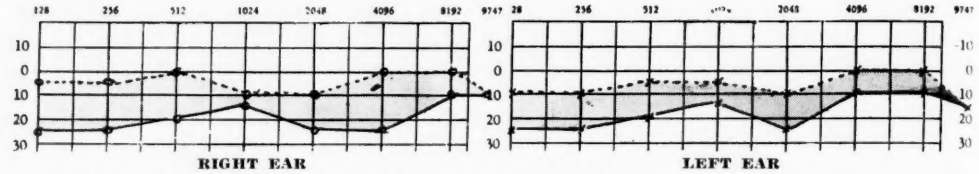

Fig. 6.—Case of H. W., aged 22, as observed from October 1946 to July 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 12.—*Hearing Losses in Case 7*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
10/23/46	17	16	16	16	7.2	Mobile	Mobile
1/ 7/47	19	14	20	17	11.6	Mobile	Mobile
3/16/47	16	11	16	18	11.4	Mobile	Mobile
7/16/47	11	9	8	16	3.1	Mobile	Mobile
11/25/47	8	7	5	11	2.1	Mobile	Mobile
1/12/48	8	4	5	11	0.9	Mobile	Mobile
1/15/49	11	11	8	9	1.4	Mobile	Mobile
1/27/49	7	7	5	8	.....	Mobile	Mobile
3/11/49	5	5	5	5	.....	Mobile	Mobile
7/11/49	4	5	5	5	.....	Mobile	Mobile

It is worthy of note that this patient was totally unaware of her hearing loss. She came under observation because of dizziness, and her loss of hearing was discovered at functional examination. Had instability of the vestibular apparatus not brought her to therapy at a time when the duration of her dysfunction was short and its evolution slight, I have no doubt that other distressing symptoms would have supervened. Her condition is now under control and will remain so if she returns for periodic functional checkups, which are necessary because there is no other means of discovering whether her deficiency is or is not a permanent one. If it is, it must be supplied (in a manner similar to the administration of insulin to diabetic patients) in order to maintain physiologic function of the auditory and vestibular mechanisms.

TABLE 13.—*Biochemical Hematologic Values in Case 7*

Constituent	Normal value	Value in Case 7
WB—Urea N	12–15	18.3
WB—Uric acid	2.5–3.5	2.3
WB—Sugar	80–120	95.0
BS—Cholesterol	160–200	166.8
BS—Phosphorus	2.5–4.0	.....
BS—Calcium	9–11	11.7
BS—Carotene	115–122	113
BS—Vitamin A	70–197	79.1
BP—Vitamin B_1	0.6	0.8
BP—Vitamin C	0.8–2.4	1.39
BS—Total protein	6.5–8.2	8.0
BS—Albumin %	4.6–6.7	6.2
BS—Globulin %	1.2–2.3	1.8

Case 7: In this case there was some degree of hyperpyruvemia but no hypercholesterolemia. Miss H. W., aged 22, had been hard of hearing for one year. There was no familial history of deafness. The patient had no tinnitus and no dizziness. She had had chickenpox, mumps and measles in childhood, as well as an abscess in the right ear. Tonsillectomy had been advised. She had worked in a noisy factory for four and one-half years.

Physical examination revealed a very small spur on the right side of the nasal septum. The tonsils were hypertrophied. The whole of the right ear

TABLE 14.—*Hearing Losses in Case 8*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
9/12/47	12	24	6	21	2.1	Mobile	Mobile
11/17/47	10	24	6	16	2.0	Mobile	Mobile
12/22/47	10	17	3	13	0.6	Mobile	Mobile
3/27/48	9	18	0	9		Mobile	Mobile
9/21/48	8	17	2	10		Mobile	Mobile
11/24/48	8	18	0	8		Mobile	Mobile
3/22/49	12	19	4	9		Mobile	Mobile

drum and also the ossicles were movable. The drum was retracted. The canal was wide. The vascular reflex was slow. There were a few atrophic spots on the drum.

The canal of the left ear was narrower than that of the right. The posterior segment was most movable, although the whole drum moved. The drum was retracted. There were no scars.

This patient presented an endocrinopathic condition. She was overweight, with adipose tissue unevenly distributed over her body.

Table 12 is a summary of the hearing losses. Although bone conduction tests were heard at all cycle frequencies, there was prolonged bone conduction in both ears. There was no raised lower tone limit above 64 double vibrations, and no familial history whatever of a heritage of deafness.

Figure 6 shows the first and the most recent audiometric charts of her hearing losses. Biochemical tests of the blood showed no hypercholesterolemia but did reveal some degree of hyperpyruvemia. The cochlear and vestibular mechanisms were evidently influenced by the hypothyroid condition. There being no positive family history of deafness, no raised lower tone limit, no impeded motion in the ossicular chains and no hypercholesterolemia, the prognosis was good for a recovery of physiologic acoustic and vestibular function if replacement therapy were instituted in addition to correction of the endocrine disturbance.

TABLE 15.—*Biochemical Hematologic Values in Case 8*

Constituent	Normal value	Value in Case 8, 9/20/47	Value in Case 8, 9/20/48
WB—Urea N	12–15	15.0	12.1
WB—Uric acid	2.5–3.5	2.45	2.38
WB—Sugar	80–120	113.0	100
BS—Cholesterol	160–200	280	280
BS—Phosphorus	2.5–4.0	9.1	3.77
BS—Calcium	9–11	9.1	9.5
BS—Carotene	115–122	122.2	117.3
BS—Vitamin A	70–197	110	93.85
BP—Vitamin B_1	0.6	0.786	0.80
BP—Vitamin C	0.8–2.4	1.9	1.64
BS—Total protein	6.5–8.2	7.08	7.1
BS—Albumin %	4.6–6.7	5.18	5.5
BS—Globulin %	1.2–2.3	1.9	1.6

Therapy aimed to correct hypothyroidism, together with a fat-free diet, brought excellent results. Time must pass before it can be determined whether the results are permanent or whether the replacement of deficiencies created by hypothyroidism will have to be indefinitely continued.

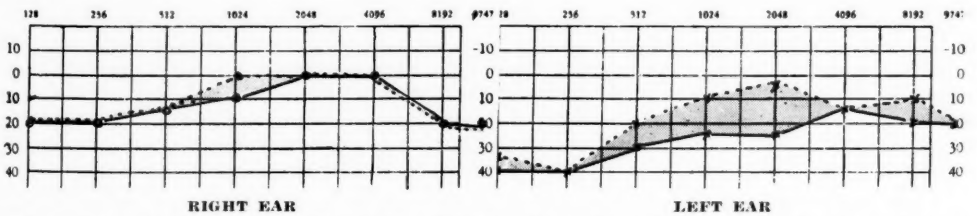

Fig. 7.—Case of A. E., aged 50, as observed from September 1947 to March 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

Case 8: Mr. A. E., aged 49, had undergone a turbinectomy twenty-seven years previously. Three or four years prior to examination he had begun to sniffle. He had trouble in breathing and was allergic. A spur had been removed from the right nostril on Oct. 3, 1941. He stated that he had rhythmic tinnitus associated with low blood pressure.

Physical examination revealed hypertrophied turbinates. The drum of the right ear was indurated. The whole drum was movable. The vascular reflex was prompt. Cerumen was present. The canal was not wide. The cough reflex was absent. The left ear showed a thinly covered perforation in the posterior superior quadrant at about 2 o'clock. The vascular reflex was slow.

A summation of the hearing losses is given in Table 14. The first and the most recent audiograms are charted in Figure 7.

The blood chemical data (Table 15) demonstrated, among other things, hypercholesterolemia and hyperpyruvemia. Under appropriate therapy (to be detailed later in this article) there was definite improvement in the hearing. An examination made one year later showed both hypercholesterolemia and hyperpyruvemia still present. Tests of hearing acuity showed improvement up to November 1948; the patient then left my control and remained away four months without therapy, believing himself cured. On his return, in March 1949, hypercholesterolemia being again observed, he was advised to resume his former diet and medicine. Whether or not he has done so is unknown.

From this case, among others in which the patients stopped their treatments, diets and medication and returned for treatment after a lapse of time, there results an impression that the therapy required is probably replacement of items lacking to the enzymatic system and that, therefore, both diet and medication will have to be continued for an indefinite time. On this question no positive opinion can be expressed at present. It is well to note, however, the level of hearing acuity on Nov. 24, 1948, and its reversion almost to its original status on March 22, 1949, between which dates the patient took no medicines and failed to maintain the diet set for him.

Case 9: D. R., a man aged 57, had had severe constant tinnitus in the right ear since the preceding September. Dizzy spells had occurred at intervals for about three months and then subsided. The hearing was affected, although there was no family history of deafness. The patient had had an attack of coronary thrombosis. His dizzy spells gave him a sensation of swaying rather than of rotation. His tinnitus sounded like "cooking water" or "waves." He had had at least two so-called head colds, with profuse watery discharge, during the winter, in which, during the second week, his chest usually became involved. Since abatement of the dizzy spells the colds had disappeared.

Physical examination revealed a small spur on the left side of the nasal septum, and another on the right (toward the front on the left and about halfway back on the right). Examination of the throat revealed a bifurcated uvula. The tonsils had been removed; there was some residue. In the right ear the ossicles were impeded in motion, the posterior segment being most movable. The drum was conical. The vascular reflex was absent, as was the cough reflex. There were no scars. A dark shadow was noted behind the umbo. In the left ear the vascular reflex was present. The posterior segment of the drum was most movable. The ossicular chain was

TABLE 16.—*Hearing Losses in Case 9*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
3/30/48	47	25	41	8	12.2	Impeded Mobility	Impeded Mobility
5/11/48	45	23	38	5	10.2	Impeded Mobility	Impeded Mobility
7/21/48	43	24	38	5	10.3	Impeded Mobility	Impeded Mobility
8/15/48	35	24	29	8	9.2	Impeded Mobility	Impeded Mobility
10/29/48	34	21	25	5	7.2	Impeded Mobility	Impeded Mobility
3/14/49	32	23	25	4	7.8	Impeded Mobility	Impeded Mobility
4/25/49	32	23	21	4	7.0	Impeded Mobility	Impeded Mobility

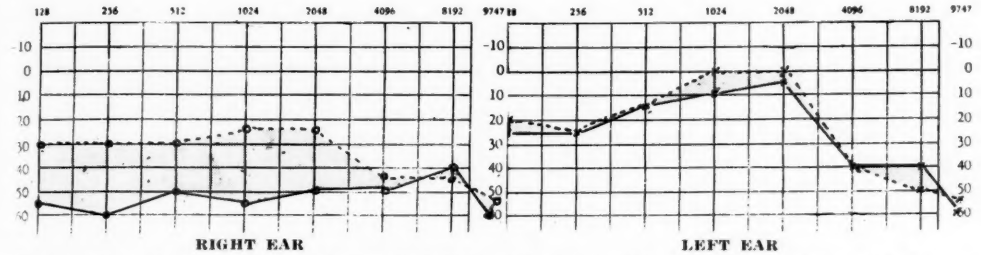

Fig. 8.—Case of D. R., aged 57, as observed from March 1948 to April 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

impeded but movable. There were no scars. The drum was approximately conical. The cough reflex was absent. Both eustachian tubes were patent. Tests for histamine sensitivity gave a 4 plus reaction.

A summary of the results of functional examination is given in Table 16. Bone conduction tests under conditions of masking showed failure of response to sound stimuli in all frequency cycle bands above 2048. In speech frequency there was a progressive loss at 512 to 2048 cycles per second. The right ear was slightly worse than the left. The results of the first and the most recent audiometric tests are shown in Figure 8. The biochemical blood values are listed in Table 17. The pertinent factors therein were hypercholesterolemia and hyperpyruvemia, which indicated impairment of the phosphorylation mechanism. (Note also the increased sugar content of the whole blood specimen. The patient was unaware of any hyperglycemia, nor had his family physician prescribed an antidiabetic diet.)

When the patient was last seen, the dizzy spells had abated, the hearing had improved, and the intensity of the tinnitus had lessened. The patient stated that he felt better under the diet and therapy administered, including histamine desensitization. Details of therapy will be given later.

Case 10: N. B., a man aged 21, had been hard of hearing for one and one-half years. There was occasional tinnitus. The patient said that he had got out of bed and lost his balance and that hearing was impaired thereafter. He complained of dizzy spells every morning on arising from bed. During the day his hearing cleared up. He was allergic to dust and to feathers. He had had asthma three years previously and complained of sinus trouble.

Physical examination of the nose revealed the ledge and spur in contact with the turbinate on the left. There was a hypertrophied middle turbinate on the right.

The tonsils had been removed.

In the right ear the whole drum was movable. The drum lacked lustre. The ossicles were movable. The vascular reflex was slow. Conditions in the left ear were identical.

This patient came under observation mostly because of faulty equilibrium. The symptoms particularly focused on dysfunction of the vestibular mechanism.

A summary of the results of functional hearing tests is shown in Table 18.

After I had detailed to him and to his physician the type of diet and medication required, the patient did not consult me again until three years and five months had elapsed. Under the administered therapy and diet his dizzy spells had abated. The imbalance in equilibrium having recurred, he again consulted me after the interval noted. The hearing loss on July 28, 1949, was considerably worsened as compared with that observed at the original test taken on Oct. 23, 1946.

TABLE 17.—*Biochemical Hematologic Values in Case 9*

Constituent	Normal value	Value in Case 9
WB—Urea N	12–15	14.6
WB—Uric acid	2.5–3.5	2.33
WB—Sugar	80–120	126.0
BS—Cholesterol	160–200	312.5
BS—Phosphorus	2.5–4.0	3.34
BS—Calcium	9–11	9.8
BS—Carotene	115–122	120.6
BS—Vitamin A	70–197	102.4
BP—Vitamin B_1	0.6	0.80
BP—Vitamin C	0.8–2.4	1.4
BS—Total protein	6.5–8.2	6.6
BS—Albumin %	4.6–6.7	4.8
BS—Globulin %	1.2–2.3	1.8

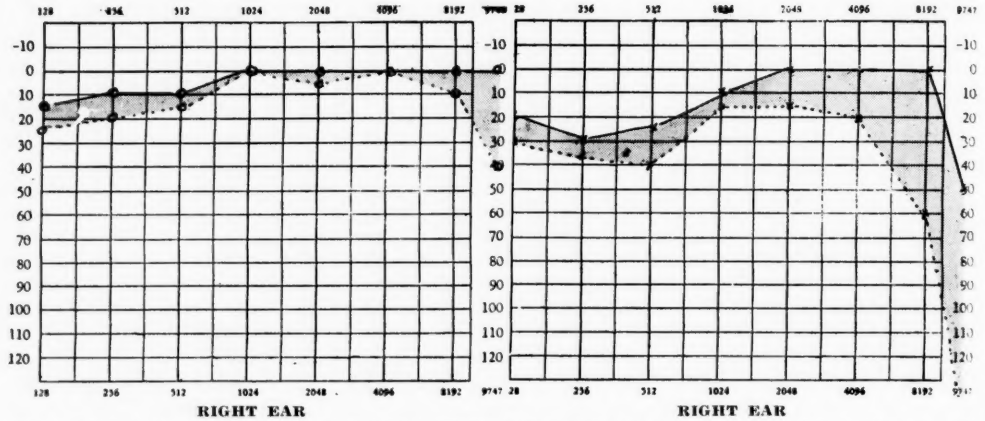

Fig. 9.—Case of N. B., aged 21, as observed from October 1946 to July 1947. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 18.—*Hearing Losses in Case 10*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
10/23/46	4 2/8	15 7/8	3	9	.....	Movable	Movable
7/28/49	15 6/8	36 7/8	7	.....	.....	Movable	Movable

Audiograms showing his hearing losses are charted in Figure 9.

Tuning fork tests revealed prolonged bone conduction in the right ear, indicative of a conduction type of deafness. In the left ear the bone conduction was shortened, indicative of a neurologic type of deafness. Yet both ossicular chains were movable. The audiometric tests of bone conduction under conditions of masking gave response in all frequency cycles tested.

TABLE 19.—*Biochemical Hematologic Values in Case 10*

Constituent	Normal value	Value in Case 10, 10/23/46	Value in Case 10, 7/26/49
WB—Urea N	12–15	15.5	14.6
WB—Uric acid	2.5–3.5	2.9	3.7
WB—Sugar	80–120	85.0	105.5
BS—Cholesterol	160–200	185.0	250.0
BS—Calcium	9–11	11.53	10.25
BS—Carotene	115–122	121.8	116.3
BS—Vitamin A	70–197	84.7	97.1
BP—Vitamin B_1	0.6	0.826	0.84
BP—Vitamin C	0.8–2.4	1.46	1.88
BS—Total protein	6.5–8.2	6.71	6.75
BS—Albumin %	4.6–6.7	4.80	4.35
BS—Globulin %	1.2–2.3	1.91	2.40

In Table 19 are the data obtained by two biochemical examinations of the blood, one when the patient first came under observation and the second after a lapse of nearly three and one-half years.

At the first examination hyperpyruvemia was evident in addition to a very low sugar content, and there were other slight trends away from the normal levels of blood constituents. In the second examination, hypercholesterolemia and hyperpyruvemia coincided with the deterioration of cochlear dysfunction, as was demonstrated by the much greater hearing losses presented.

The excess of calcium may be ascribed to either of two factors or it may contribute to both. In a study published in 1925[6] of the calcium content of the blood in cases of otoselerosis, I expressed the opinion that

TABLE 20.—*Hearing Losses in Case 11*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
10/29/48	45 1/8	31	51	35	45.5	Movable	Movable
6/13/49	41 3/8	27 4/8	47	33	40.3	Movable	Movable
7/11/49	40	25 2/8	44	32	34.8	Movable	Movable

calcium in excess of the normal amount meant leakage from its storage in the bone and hence could be interpreted as indicating an active otosclerotic lesion in the bone.

In view of the second blood chemical examination in Case 10, I had no doubt that there was an active lesion, despite the absence of a positive familial history of deafness. In this case the lesion had not been active for any great length of time. Additional evidence in support of my diagnosis was afforded by the patient's basal metabolic rate, which was –22. The diagnosis of subclinical hypothyroidism was sustained.

The other factor aforementioned stems from the phosphorus-calcium imbalance that existed as a background to the patient's allergy. His tests for histamine sensitivity resulted in a 4 plus reaction. He is now undergoing desensitization.

This patient is improving under measures that will be detailed in the section headed "Therapy."

Case 11: Mrs. F. B., aged 41, had a history of tinnitus in the right ear, of one month's duration and occasionally changing in character.

TABLE 21.—*Biochemical Hematologic Values in Case 11*

Constituent	Normal value	Value in Case 11, 11/9/48	Value in Case 11, 7/15/49
WB—Urea N	12–15	13.0	16.8
WB—Uric acid	2.5–3.5	3.4	3.15
WB—Sugar	80–120	113.0	126.0
BS—Cholesterol	160–200	312.5	250.0
BS—Phosphorus	2.5–4.0	2.7	3.63
BS—Calcium	9–11	10.8	9.8
BS—Carotene	115–122	115.2	117.3
BS—Vitamin A	70–197	92.16	93.7
BP—Vitamin B_1	0.6	0.816	0.826
BP—Vitamin C	0.8–2.4	1.7	1.56
BS—Total protein	6.5–8.2	6.5	6.5
BS—Albumin %	4.6–6.7	4.85	4.7
BS—Globulin %	1.2–2.3	1.65	1.8

There had also been loss of hearing in the right ear for about one month. There was no vomiting. There had never been any discharge from the ears. Colds were frequent. There was no familial history of deafness. Disease of the gallbladder and arthritis were present. The patient complained of frequent headaches. There was a history of measles, whooping cough and chickenpox. The patient had vague dizzy spells and fainted occasionally (once in approximately two months). She had two children.

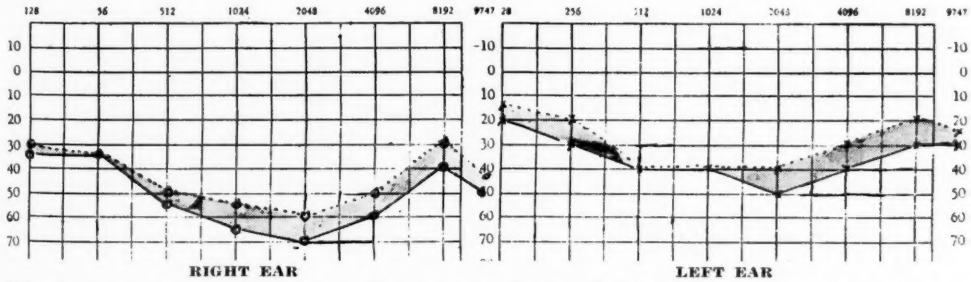

Fig. 10.—Case of F. B., aged 41, as observed from October 1948 to July 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

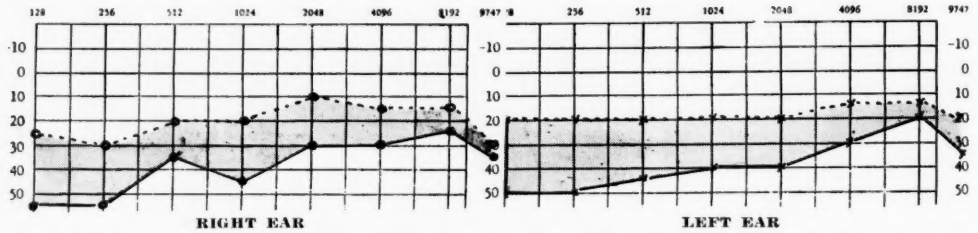

Fig. 11—Case of M. M., aged 31, as observed from September 1946 to November 1948. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 22.—*Hearing Losses in Case 12*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
9/11/46	35	35	29	33	27.3	Movable	Movable
11/ 1/46	38	34	28	34	.....	Movable	Movable
12/ 9/46	32	34	29	34	.....	Movable	Movable
1/ 6/47	31	33	29	37	.....	Movable	Movable
2/25/47	30	32	25	37	20.3	Movable	Movable
3/22/47	30	26	25	35	19.4	Movable	Movable
7/21/47	27	26	21	31	12.8	Movable	Movable
11/25/47	25	24	20	27	10.9	Movable	Movable
1/ 7/48	24	22	19	28	10.3	Movable	Movable
5/19/48	22	22	15	25	7.0	Movable	Movable
7/ 7/48	21	22	15	23	7.1	Movable	Movable
7/30/48	20	17	13	16	4.7	Movable	Movable
11/ 5/48	18	16	13	16	4.2	Movable	Movable

Physical examination revealed polyps on the right side of the nasal septum from the ethmoidal area. The tonsils had been removed. There was granular pharyngitis.

TABLE 23.—*Biochemical Hematologic Values in Case 12*

Constituent	Normal value	Value in Case 12
WB—Urea N	12–15	13.8
WB—Uric acid	2.5–3.5	1.5
WB—Sugar	80–120	78.5
BS—Cholesterol	160–200	155.0
BS—Phosphorus	.....	.....
BS—Calcium	9–11	9.0
BS—Carotene	115–122	113.6
BS—Vitamin A	70–197	79.1
BP—Vitamin B_1	0.6	0.826
BP—Vitamin C	0.8–2.4	1.34
BS—Total protein	6.5–8.2	6.95
BS—Albumin %	4.6–6.7	4.57
BS—Globulin %	1.2–2.3	2.38

In the right ear, the whole drum moved. The ossicles were movable. The vascular reflex was absent. Cerumen was present. The canal was not wide. In the left ear, the posterior part was movable. The vascular reflex was present. The canal was not wide. There were no atrophic spots. The eustachian tubes were patent. The blood pressure was 129 systolic and 90 diastolic. The histamine sensitivity was 4 plus.

A summation of the hearing losses is shown in Table 20.

The first and the most recent audiograms are charted in Figure 10. Bone conduction tests under conditions of masking evoked no response to the frequency cycles of 2048, 4096 and other frequencies at the 10-decibel level in both ears. There was prolonged bone conduction, and a raised lower tone limit was noted above the 64 double vibration level.

The results of chemical examinations of the blood are shown in Table 21.

At the first blood test a high degree of hypercholesterolemia was shown together with

hyperpyruvemia. In the second examination the hypercholesterolemia had improved under diet, medication and desensitization processes to correct histamine hypersensitivity. The functional tests seemed to indicate that an otosclerotic lesion was present. Yet after histamine desensitization the calcium content reached the level of low normal, and the patient denied any familial history of deafness.*

Disease of the gallbladder and rheumatoid arthritis were also pertinent factors in influencing the results of examination.

The duration of hearing loss and tinnitus as given in the history must be discounted also. It is difficult to concede that in one month these conditions could bring about the degree of cochlear and vestibular dysfunction evidenced by the functional examination, particularly with an unimpeded ossicular chain movement in both ears (although slightly limited in motion in the *left* ear, which happened to be the better hearing ear).

Under the administered therapy the hearing is improving.

Case 12: Mrs. M. M., aged 31, presented a marked contrast to the patients whose cases are cited above as showing hypocholesterolemia and hyperpyruvemia.

She had been hard of hearing since pregnancy eight years before. Her trouble started with pounding tinnitus, later changing to "whistle" tinnitus. There was no familial history of deafness. She had had chickenpox, measles and whooping cough in childhood. She had never had discharging ears. She had been told that she had a heart murmur. She was anemic.

*It is extremely difficult to persuade patients to admit a heritage of deafness in the family. I often discount the story of a "negative" family history when functional tests and examinations of the blood give evidence to the contrary. In a subsequent paper the heritage of deafness will be discussed specifically.

Physical examination revealed a deflected nasal septum, with a spur to the left. The tonsils had been removed. The pharynx was clean. The canal of the right ear was narrow. Cerumen was present. The posterior segment of the drum was most movable. The ossicles were movable. The vascular reflex was slow. The cough reflex was absent. The condition of the left ear was similar to that of the right.

The first and the most recent audiograms are charted in Figure 11. Bone conduction tests under conditions of masking indicated hearing at all frequency cycles with both ears. There was no prolonged bone conduction, but the lower tone was raised above the 64 double vibration level in both ears, according to tests with tuning forks. A summation of the numerous audiometric hearing tests is given in Table 22.

The biochemical blood values are summarized in Table 23. There was but one pertinent observation, namely hyperpyruvemia, denoting a deficiency in the diphosphothiamine-magnesium-protein item of the vitamin B group. There was also too low a level of sugar in the blood. Either this evidenced an overactivity of the insulin factor or the liver was handicapped in delivery of this item to the blood stream.

Under a regulatory diet, administration of thyroid extract and replacement therapy to overcome the deficiency indicated by the hyperpyruvemia, this patient, in the course of little over a year, improved her hearing acuity so that, when her disability was estimated binaurally by the Bunch method, the dysfunction could be estimated at 4.2 per cent of disability in hearing the spoken voice. This patient must report once in a while for rechecks of her hearing because of two factors: the onset coincidental with a pregnancy, and the raised lower tone limit above the 63 double vibration level.

Case 13: Mrs. B. M., aged 36, presented all the factors to substantiate a diagnosis of otosclerosis. During four pregnancies her ears had become clogged. She complained of a "feeling like going into an elevator." She had lost two children. Her father was hard of hearing. Her own loss of hear-

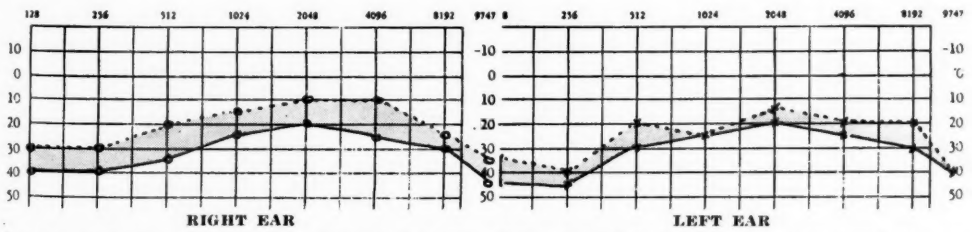

Fig. 12.—Case of B. M., aged 36, as observed from June 1948 to June 1949. Solid line, first test; dotted line, last last test; shaded area, gain in decibels.

TABLE 24.—*Hearing Losses in Case 13*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
6/23/48	29	30	21	20	10.9	Partly movable	Impeded
9/15/48	27	25	19	19	8.6	Partly movable	Impeded
10/20/48	25	24	17	19	7.8	Partly movable	Impeded
11/17/48	22	26	15	19	5.7	Partly movable	Impeded
12/15/48	24	26	16	18	6.4	Partly mobavle	Impeded
1/12/49	21	24	13	17	4.8	Partly movable	Impeded
3/ 7/49	22	22	17	16	6.8	Partly movable	Impeded
4/ 4/49	19	25	12	16	3.3	Partly movable	Impeded
5/ 6/49	19	25	12	16	3.0	Partly movable	Impeded

ing had been first noticed at a World's Fair test. She had had diphtheria, colds, pneumonia, whooping cough and measles in childhood. She stated that she had formerly had frequent colds, but not recently. There was no history of hay fever. Her father was 78 years old, but had been hard of hearing for many years; he was hard of hearing even in his prime.

Physical examination revealed no nasal abnormality. The tonsils had been cleanly removed, with some residue. The canal of the right ear was not wide. The whole drum moved. The ossicles were impeded in motion. The vascular reflex was absent. There was an atrophic spot about 9 o'clock inward to the hammer handle, and a small scar was noted just above the short process. The drum of the left ear was an exact counterpart of the right drum. The canal was moderately wide. There was one atrophic spot at about 3 o'clock. Both eustachian tubes were patent. The histamine sensitivity test evoked a 4 plus reaction.

TABLE 25.—*Biochemical Hematologic Values in Case 13*

Constituent	Normal value	Value in Case 13
WB—Urea N	12–15	14.2
WB—Uric acid	2.5–3.5	2.6
WB—Sugar	80–120	101.8
BS—Cholesterol	160–200	215.0
BS—Phosphorus	2.5–4.0	3.8
BS—Calcium	9–11	10.2
BS—Carotene	115–122	120.5
BS—Vitamin A	70–197	96.2
BP—Vitamin B_1	0.6	0.84
BP—Vitamin C	0.8–2.4	1.4
BS—Total protein	6.5–8.2	6.90
BS—Albumin %	4.6–6.7	4.75
BS—Globulin %	1.2–2.3	1.15

The first audiograms and the most recent ones are charted in Figure 12. Bone conduction tests under conditions of masking indicated hearing at all frequency cycles. There was prolonged bone conduction, and a raised lower tone limit was noted above the 64 double vibration level in both ears. The ossicular chains were impeded bilaterally.

This patient presented the elements of Bezold's triad to warrant a diagnosis of otosclerosis: (1) a positive family heritage of deafness, (2) prolonged bone conduction and (3) a lower tone limit raised above the 63 double vibration level. A summation of the results of hearing tests is given in Table 24. Gradual reversal of the biochemical processes by medical therapy was striking in this case. The results of biochemical tests of the blood are shown in Table 25. The pertinent observations were a degree of hypercholesterolemia and hyperpyruvemia, associated with an imbalance in the calcium-phosphorus ratio.

Under a regulatory diet and medication designed (1) to control the dysfunction at the cochlear and vestibular mechanisms (the patient suffered equilibrial imbalance in that she had sensations as if she were going suddenly upward in an elevator) and (2) to supply the deficiency indicated by the hyperpyruvemia, the factors at fault in her illness were brought to a halt, with evident practical improvement in her hearing mechanisms. The patient is still under observation.

Cases 14, 15, 16 and 17: Enough case histories have been sketched to show that, among adult patients, hypercholesterolemia and hyperpyruvemia, when found either separately or together in a given case, denote a physiologic enzymatic dysfunction as the pertinent background to symptoms of

deafness and vertigo—and, among adults, tinnitus of various kinds. The adult patients whose cases are here detailed are a sampling from among hundreds that have been studied.

In cases 14, 15, 16 and 17, therefore, it is proposed only to present tables in which the hearing tests and the blood biochemical data are placed side by side for comparison, because these 4 patients were two sets of sisters, all of whom were deafened. See Table 26 for comparison of blood chemical values of 2 of the sisters. It is noteworthy that both showed hypercholesterolemia and hyperpyruvemia.

In the case of Mrs. I. B., physical examination revealed that the canal of the right ear was not enlarged beyond the normal range. There was no cerumen. The posterior segment was most movable. The ossicles were impeded in motion. The vascular reflex was absent. The cough reflex was absent. The drum had calcareous deposits at about 6 o'clock. The left ear was in the same condition. There was one atrophic spot on the drum.

Bone conduction tests taken under conditions of masking showed responses to three frequencies only in both ears. There was prolonged bone conduction. The lower tone limit was raised. There was a familial history of deafness. A diagnosis of otosclerosis appeared warranted.

Physical examination of the other sister, Mrs. A. L., revealed a mild deflection of the nasal septum to the left. The throat was normal. The canal of the right ear was moderately wide. No cerumen was present. The skin was thin. The whole drum was movable, as were the ossicles. The vascular reflex was fairly prompt. The cough reflex was absent. The condition of the left ear was the same. The posterior segment of the drum was most movable. Both eustachian tubes were patent.

Bone conduction tests taken under conditions of masking showed responses to all frequencies. There were prolonged bone conduction and a raised lower tone limit, plus a familial history of deafness. This case also presented the Bezold triad and warranted a diagnosis of otosclerosis.

Table 27 presents a comparison of the biochemical blood values in Cases 16 and 17, in which the patients were also sisters (Miss S. L. and Miss B. L.).

In both of these cases there were hypercholesterolemia and hyperpyruvemia.

Physical examination of Miss S. L. revealed a small spur at the base of the nasal septum, on the left side. The tonsils were moderately infected. The canal of the right ear was wide. There were no scars and no deposits. The posterior segment was most movable. The ossicles were impeded, although there was some motion. The vascular reflex was slow. The drum of the left ear was a little thickened. The ossicles were impeded. The vascular reflex was slow and the cough reflex was absent. The histamine sensitivity reaction was 4 plus.

TABLE 26.—*Biochemical Hematologic Values in Cases 14 and 15*

Constituent	Normal value	Value in Case 14*	Value in Case 15†
WB—Urea N	12–15	14.3	15.3
WB—Uric acid	2.5–3.5	2.0	2.25
WB—Sugar	80–120	100	88.5
BS—Cholesterol	160–200	215	380
BS—Phosphorus	2.5–4.0	.....	.....
BS—Calcium	9–11	10.0	10.5
BS—Carotene	115–122	119.3	116.5
BS—Vitamin A	70–197	83.5	81.5
BP—Vitamin B_1	0.6	0.826	0.906
BP—Vitamin C	0.8–2.4	1.20	1.32
BS—Total protein	6.5–8.2	6.24	6.09
BS—Albumin %	4.6–6.7	4.27	4.80
BS—Globulin %	1.2–2.3	.....	1.29

*Case of Mrs. I. B., aged 45. Acoustic nerve deafness and conduction deafness. Patient underwent fenestration procedure. Whole range loss, right ear 67%; left ear, 68%. Speech range loss, right ear, 49%; left ear, 50%

†Case of Mrs. A. L., aged 37. Acoustic nerve deafness and conduction deafness. Unilateral. Whole range loss, right ear, 5%; left ear, 30%. Speech range loss, right ear, 5%; left ear, 27%. Binaural loss, 2.8%

TABLE 27.—*Biochemical Hematologic Values and Hearing Losses in Cases 16 and 17*

Constituent	Normal value	Value in Case 16*	Value in Case 17†
WB—Urea N	12–15	15.0	12.2
WB—Uric acid	2.5–3.5	2.7	2.1
WB—Sugar	80–120	90.0	105.5
BS—Cholesterol	160–200	215	452
BS—Phosphorus	2.5–4.0	3.09	3.0
BS—Calcium	9–11	9.09	9.7
BS—Carotene	115–122	117.2	120.2
BS—Vitamin A	70–197	98.3	100.0
BP—Vitamin B_1	0.6	0.816	0.786
BP—Vitamin C	0.8–2.4	1.12	1.7
BS—Total protein	6.5–8.2	6.9	6.75
BS—Albumin %	4.6–6.7	4.8	5.05
BS—Globulin %	1.2–2.3	2.1	1.07

*Case of Miss S. L., aged 27. Ossicular chain impeded. Whole range loss, right ear, 28%; left ear, 30%. Speech range loss, right ear, 29%; left ear, 29%. Binaural loss, 26.3%

†Case of Miss B. L., aged 33. Psychogenic history (emotional upset etc.); ossicular chain much impeded. Whole range loss, right ear, 44%; left ear, 45%. Speech range loss, right ear, 33%; left ear, 33%. Binaural loss, 29.7%. Later tests showed some variation: Whole range loss, right ear, 44%; left ear, 43%. Speech range loss, right ear, 32%, left ear, 32%. Binaural loss, 31.6%

TABLE 28.—*Biochemical Hematologic Values and Hearing Losses in Cases 18 and 19*

Constituent	Normal value	Value in Case 18*	Value in Case 19†
WB—Urea N	12–15	14.4	15.0
WB—Uric acid	2.5–3.5	2.2	2.8
WB—Sugar	80–120	86.5	95.0
BS—Cholesterol	160–200	180.0	177.5
BS—Phosphorus	2.5–4.0	3.85	3.63
BS—Calcium	9–11	10.2	10.3
BS—Carotene	115–122	121.7	120.6
BS—Vitamin A	70–197	103.4	102.3
BP—Vitamin B_1	0.6	0.816	0.826
BP—Vitamin C	0.8–2.4	1.23	1.81
BS—Total protein	6.5–8.2	6.90	6.75
BS—Albumin %	4.6–6.7	4.75	4.15
BS—Globulin %	1.2–2.3	2.15	2.60

*Case of Mrs. A. M., aged 29. Acoustic nerve deafness and conduction deafness. Whole range loss, right ear, 76%; left ear, 71%. Speech range loss, right ear, 69%; left ear, 60%. Binaural loss, 92.1%

†Case of Mrs. M. C., aged 23. Conduction deafness; prolonged bone conduction; raised lower tone limit. Whole range loss, right ear, 47%; left ear, 61%. Speech range loss, right ear, 33%; left ear, 37%. Binaural loss, 37%

Bone conduction tests taken under conditions of masking showed response to all frequencies in both ears. A raised lower tone limit, markedly prolonged bone conduction, and a familial history of deafness were noted, warranting a diagnosis of otosclerosis.

Physical examination of the other sister, Miss B. L., revealed no nasal abnormality. The throat was also normal. The canal of the right ear was not wide. The posterior segment of the drum was most movable. The vascular reflex was moderately prompt. The drum was retracted. The ossicles were movable but impeded. There were no scars and no atrophic spots. The ossicles of the left ear were much more impeded than those of the right. The canal was not wide. There were no scars and no atrophic spots. Both eustachian tubes were patent.

Bone conduction tests taken under conditions of masking showed response to 512, 1024 and 2048 cycles per second only, in both ears. A raised lower tone limit, prolonged bone conduction and a familial history of deafness warranted the diagnosis of otosclerosis.

Cases 18 and 19 (Table 28): Here another set of deafened sisters' blood biochemical data are shown.

In neither of these two sisters was there any evidence of hypercholesterolemia, but in both, among other biochemical abnormalities, appeared a deficiency in the diphosphothiamine-magnesium-protein item of the vitamin B group. In both there was a low sugar content, and in both an imbalance in the phosphorus-calcium ratio was noted. The older sister had been subjected to the noise of factory machines for ten consecutive years. With the deficiency indicated by the hyperpyruvemia present in both, one can comprehend the acoustic trauma suffered by the cochlear nerve during this period, since the myelin sheath of the nerve could not be maintained at optimal physiologic function because of the deficiency incident to hyperpyruvemia. To a lesser degree this deficiency produced deterioration at the nerve synapses and terminals, even though a greater degree of hyperpyruvemia was present in the younger sister.

Case 20: In the case of S. T., aged 9, I present hematologic data on both the child and her mother. The child was severely deafened, and talked only a little at about the age of 2 years. She was born with a tumor on her lip and a lesion, type undetermined, just in front of the tragus of her left ear, to which radium therapy had been applied. The tumor on the lip was surgically removed during first weeks of life. There was a sibling who had normal hearing.

The child S. T. was extremely nervous. It was impossible to get an audiometric test during the first visit. Subsequently her responses were so at variance with the facts that talking to her through the calibrated voice to ear phones, first on one ear, then on the other and then bilaterally, was the only possible means of appraising her hearing acuity and particularly her hearing losses.

Table 30 presents the biochemical blood data of

TABLE 29.—*Hearing Losses in Case 20*

Date	Whole range loss, %		Speech range loss, %		Speech reception,* db.		
	Right ear	Left ear	Right ear	Left ear	Right ear	Left ear	Binaural
3/28/49	71	97	65	100	55	0	.....
5/19/49	.....	.....	.....	.....	50	0	35

*With Landis speech reception machine

TABLE 30.—*Biochemical Hematologic Values in Case 20*

Constituent	Normal value	Value for mother 6/28/49	Value for daughter 4/9/49	Value for daughter 6/28/49
WB—Urea N	12–15	14.5	15.4	15.1
WB—Uric acid	2.5–3.5	2.5	3.1	3.1
WB—Sugar	80–120	100	112.5	105.5
BS—Cholesterol	160–200	280	305.0*	187.0*
BS—Phosphorus	2.5–4.0	3.63	2.78	5.05
BS—Calcium	9–11	9.9	10.2	9.4
BS—Carotene	115–122	118.6	118.6	120.5
BS—Vitamin A	70–197	100.8	100.2	100.8
BP—Vitamin B_1	0.6	0.6	0.80	0.816
BP—Vitamin C	0.8–2.4	1.06	1.78	1.18
BS—Total protein	6.5–8.2	7.15	6.55	6.25
BS—Albumin %	4.6–6.7	4.50	4.60	3.95
BS—Globulin %	1.2–2.3	2.65	1.95	2.30

*High normal cholesterol level for child was 190 mg. per 100 cc.

both mother and daughter. There are two tests of the latter.

The mother was not my patient. It would therefore have been embarrassing to ask her to submit to a hospital checkup to determine the factors at fault in her case, although a pathologic condition was evident in her blood. She presented hypercholesterolemia, an imbalance in the calcium-phosphorus ratio and an imbalance in the protein-albumin ratio.

I have no knowledge of how long these dysfunctions had existed. One possibility is that the patient had asymptomic otosclerosis; that is asymptomatic as far as the cochlear and vestibular mechanisms were concerned. None the less she had given her daughter the inheritance, and in the child the disease was symptomatic as regards the ear and its mechanisms. On the other hand, the mother's hypercholesterolemia may have been the result of some other deficiency disease, undiagnosed as yet.

The daughter presented a high degree of hypercholesterolemia at the first blood examination, relatively much higher than that of the mother, since that of the latter was but 80 mg. per hundred cubic centimeters in excess, while that of the daughter was 210 mg. in excess of the high normal range. The daughter also showed a degree of hyperpyruvemia.

The child was fitted with a hearing aid and given a regulatory diet. Medical therapy was instituted to achieve a reversal of the chemical processes at fault, and she was recommended to a school that would teach her the meaning of sound symbols, which she was able to hear by means of the hearing aid.

At the second examination, approximately two months later, her hearing and listening faculties, tested with the Landis speech recording machine, gave evidence of improvement in both. Coincidentally with the better functioning of the cochlear mechanisms, examination of the blood showed the cholesterol level to be within normal limits. A degree of hyperpyruvemia was observed, for the correction of which replacement of the items in the Vitamin B group was prescribed. The patient's behavior was also much improved at the second examination.

TABLE 31.—*Biochemical Hematologic Values and Hearing Losses in Cases 21 and 22*

Constituent	Normal value	Value in Case 21*	Value in Case 22†
WB—Urea N	12–15	13.88	15.3
WB—Uric acid	2.5–3.5	2.6	2.2
WB—Sugar	80–120	75.0	108.8
BS—Cholesterol	160–200	280	250.0
BS—Phosphorus	2.5–4.0	4.50	.....
BS—Calcium	9–11	9.6	.....
BS—Carotene	115–122	118.8	117.6
BS—Vitamin A	70–197	99.1	98.4
BP—Vitamin B_1	0.6	0.786	0.786
BP—Vitamin C	0.8–2.4	1.47	1.29
BS—Total protein	6.5–8.2	7.15	.....
BS—Albumin %	4.6–6.7	4.50	.....
BS—Globulin %	1.2–2.3	2.65	.....

*Case of Mrs. L. R., aged 33. Whole range loss, right ear, 56%; left ear, 34%. Speech range loss, right ear, 52%; left ear, 28%. Binaural loss, 28%

†Case of Master D. R., aged 6. Diagnosis: audiomutism. Child could hear but refused to acknowledge symbols (psychogenic deafness). Heard sounds at 50 decibels spoken to him through Landis speech reception machine

TABLE 32.—*Biochemical Hematologic Values in Case 23*

Constituent	Normal value	Value in Case 23
BS—Cholesterol	160–190	265
WB—Sugar	80–120	95

Cases 21 and 22: For the purpose of this communication there is no point in repeating the familiar story of a mother's deafness and a congenitally deafened child.

It is of great interest to compare the blood of the mother, aged 33 years, and that of the son, aged 6 years (see Table 31).

Both showed hypercholesterolemia, but the child's condition was relatively worse than the mother's; in the case of the child the high normal value was 190 mg. per hundred cubic centimeters. In both mother and child hyperpyruvemia was evident. There was some indication that psychogenic factors were involved. I am unready to report this at present, but I put the cases on record, noting that the mother had suffered a "nervous breakdown" and that my diagnosis in the child's case was audiomutism. (A separate report on a number of children's cases is in preparation).

TABLE 33.—*Biochemical Hematologic Values in Case 24*

Constituent	Normal value	Value in Case 24
WB—Urea N	12–15	13.5
WB—Uric acid	2.5–3.5	3.0
WB—Sugar	80–120	100 0
BS—Cholesterol	160–190	435.0
BS—Phosphorus	2.5–4.0	4.76
BS—Calcium	9–11	10.2
BS—Carotene	115–122	116.8
BS—Vitamin A	70–197	98.6
BP—Vitamin B_1	0.6	0.856
BP—Vitamin C	0.8–2.4	1.2
BS—Total protein	6.5–8.2	6.75
BS—Albumin %	4.6–6.7	4.85
BS—Globulin %	1.2–2.3	1.9

Case 23: F. G., aged 19 months, did not respond to sound. The birth was normal. The mother had 3 children, 2 of whom were apparently normal. The mother took no quinine during pregnancy. F. G. had apparently never been ill at all.

Physical examination revealed a well nourished child, normal as to skeletal structure and musculature. Both ears were otoscopically normal. The child had hypertrophied tonsils.

Functional examination elicited a palpebral reflex when the C-4 fork was sounded at the concha.

Hematologic examination was limited to two factors which I desired particularly to investigate. To take the larger quantity of blood for a complete examination, as is usual in my cases, was not deemed wise because of the child's age (see Table 32). The pertinent factor here was the marked hypercholesterolemia—175 mg. per hundred cubic centimeters in excess of the high normal range. The degree of acoustic dysfunction coincided with the biochemical pathologic condition of the blood. Sugar was studied because in many other cases in this study hypoglycemia was discovered, coincidental with a handicapped and dysfunctioning central nervous system, while the peripheral acoustic end organs were not pathologically involved. Diagnostically it was decided that the child did hear some sounds, and the educational features of therapy were deferred for the time being. However, medication aimed at reversal of the chemical processes resulting in hypercholesterolemia at an age of less than 2 years has been begun.

Case 24: J. B., aged 2 years, was mentally alert but neither spoke nor responded to sound symbols. There was some reaction to a high-pitched whistle and to the C-4 fork with Barany's noise apparatus in the opposite ear.

The blood chemical data are shown in Table 33. They indicate a high degree of hypercholesterolemia and hyperpyruvemia.

Case 25: M. L., aged 10 years, was allergic and suffered loss of hearing in the right ear after a fall on the pavement about six years prior to examination. There was no discharge after the fall. The child was unconscious for about six hours. Recovering consciousness, he could not see or hear until the following day. His neck was dislocated two and a half years later. The mother's brother was hard of hearing. The patient's tonsils had been removed at the age of 3½ years. There was no tinnitus. He was a very nervous child.

Physical examination revealed a watery nasal discharge. The tonsils had been removed. There were granulations on the pharyngeal walls. The remains of adenoids were noted.

The drum of the right ear was conical. The most movable part was the posterior segment. The ossicles were movable. There was slight dullness due to thickening. The ear was not normally translucent. Cerumen was present. The vascular reflex was very slow, and the cough reflex was absent. There was no atrophy. In the left ear the ossicular chain was impeded in motion.

The first and the most recent audiograms are

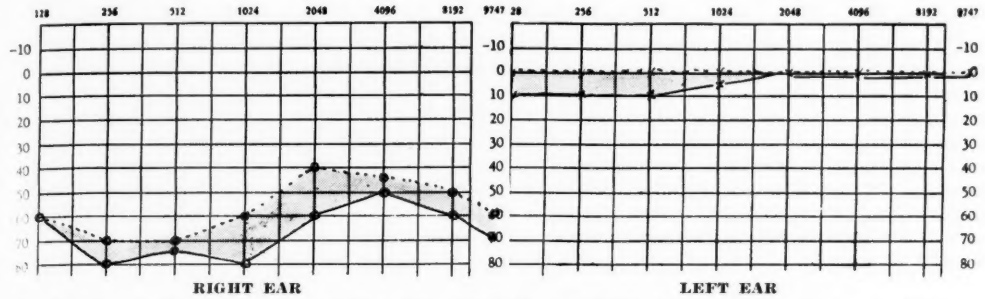

Fig. 13.—Case of M. L., aged 10, as observed from March 1948 to February 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

TABLE 34.—*Hearing Losses in Case 25*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
4/ 1/48	60	4	57	4	10.1	Mobile	Impeded
5/ 1/48	56	2	56	2	8.5	Mobile	Impeded
6/ 7/48	54	3	49	0	7.9	Mobile	Impeded
7/ 6/48	52	0	47	0	7.0	Mobile	Impeded
9/24/48	51	0	45	0	6.8	Mobile	Impeded
11/19/48	50	1	45	0	6.6	Mobile	Impeded
12/27/48	50	0	45	0	6.8	Mobile	Impeded
1/24/49	50	0	45	0	6.6	Mobile	Impeded
2/28/49	51	0	49	0	6.8	Mobile	Impeded

charted in Figure 13. Tuning fork tests revealed prolonged bone conduction and a raised lower tone limit above 64 double vibrations in the right ear only. The patient gave a 4 plus reaction to histamine sensitivity tests.

A summation of the hearing losses, tested audiometrically, is given in Table 34.

On May 11, 1948, the patient was tested for his faculty of listening and also for discriminatory listening, while his environment was not soundproof and silent. With the Landis speech recording machine, no totally correct speech responses were made with the right ear, but listening was good at the 20-decibel level, and binaurally at normal voice levels.

The paradoxic phenomenon of better hearing in the left ear, in which mobility of the ossicular chain was impeded, remains unexplained.

The blood biochemical data are detailed in Table 35. The presence of hypercholesterolemia and hyperpyruvemia in this 10-year-old boy coincided with the great degree of his losses in hearing acuity.

The positive family history of deafness, the prolonged bone conduction, and the raised

TABLE 35.—*Biochemical Hematologic Values in Case 25*

Constituent	Normal value	Value in Case 25
WB—Urea N	12–15	12.5
WB—Uric acid	2.5–3.5	2.8
WB—Sugar	80–120	90.0
BS—Cholesterol	160–200	280.0
BS—Phosphorus	2.5–4.0	4.5
BS—Calcium	9–11	10.1
BS—Carotene	115–122	115.77
BS—Vitamin A	70–197	93.0
BP—Vitamin B_1	0.6	0.856
BP—Vitamin C	0.8–2.4	1.20
BS—Total protein	6.5–8.2	7.5
BS—Albumin %	4.6–6.7	5.5
BS—Globulin %	1.4–2.3	2.0

TABLE 36.—*Hearing Losses in Case 26*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %
	Right ear	Left ear	Right ear	Left ear	
7/21/48	30	34	29	31	36.0
10/ 9/48	27	32	27	29	30.0
3/15/49	26	28	25	25	26.7
7/ 8/49	29	29	24	24	24.0

lower tone limit in the right ear leave the impression that, had not corrective diet and medication aimed at reversal of the dysfunctioning chemical processes been successful, it would have been only a short time before these same conditions would have been presented by the left ear. The condition warranted a diagnosis of otosclerosis, with uneven status of evolutionary development due to trauma in the right ear.

In the course of nearly a year, the hearing loss has been reduced and the left ear has been brought to levels of normal hearing and listening.

Study of this case is being continued to determine, among other things, whether the medication will have to be indefinitely maintained.

Case 26: F. C., a girl aged 15 years, had suffered loss of hearing from childhood. She had never had a discharge from her ears. Her father's sister and an uncle on the grandmother's side were deafened. The patient had had chickenpox and measles in childhood. During the winter just prior to examination there were frequent colds. She also had hay fever.

TABLE 37.—*Results of Listening Tests* in Case 26*

Date	Listening with right ear	Listening with left ear	Binaural listening
10/9/48	15	15	15
7/8/49	5	5	5

*Speech listening with Landis speech reception machine

TABLE 38.—*Biochemical Hematologic Values in Case 26*

Constituent	Normal value	Value in Case 26, 7/22/48	Value in Case 26, 7/11/49
WB—Urea N	12–15	11.6	13.8
WB—Uric acid	2.5–3.5	3.15	2.2
WB—Sugar	80–120	100.0	112.5
BS—Cholesterol	160–190	175.0	222.5
BS—Phosphorus	2.5–4.0	4.26	3.67
BS—Calcium	9–11	11.1	10.2
BS—Carotene	115–122	117.3	118.6
BS—Vitamin A	70–197	107.1	101.2
BP—Vitamin B_1	0.6	0.80	0.786
BP—Vitamin C	0.8–2.4	0.771	1.31
BS—Total protein	6.5–8.2	7.8	6.40
BS—Albumin %	4.6–6.7	6.0	4.20
BS—Globulin %	1.2–2.3	1.8	2.20

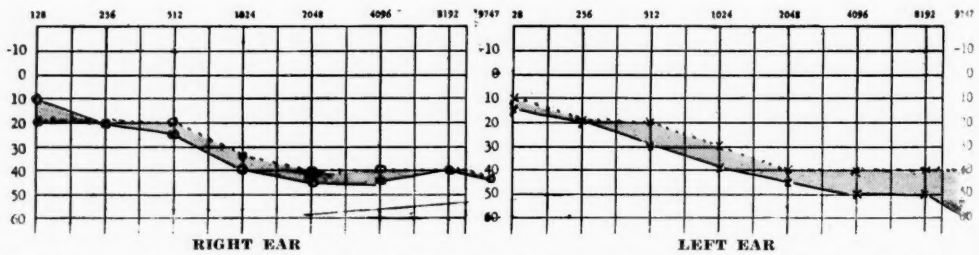

Fig. 14.—Case of F. C., aged 15, as observed from July 1948 to September 1949. Solid line, first test; dotted line, last test; shaded area, gain in decibels.

Physical examination revealed polypoid ethmoiditis at the left side of the nose. The tonsils had been removed. There was granular pharyngitis. The canal of the right ear was wide. The whole drum moved. The ossicles also were movable. The vascular reflex was very slow. The posterior segment of the drum was most movable. There was a calcareous deposit on the drum. The left ear presented an atrophic spot behind the hammer handle. The posterior segment was the most movable portion of the drum. The ossicles were impeded in motion. The vascular reflex was very slow. Cerumen was present. The cough reflex was absent. There was some atrophy of subcutaneous tissue in both external auditory canals. Both eustachian tubes were patent. Tests for histamine sensitivity gave a 4 plus reaction.

The earliest and the most recent audiograms are charted in Figure 14. Fork tests showed prolonged bone conduction but absence of a raised lower tone limit. A summation of the hearing losses is given in Table 36.

The results of the functional tests aforementioned seemed out of line to me because of the patient's excellent responses to ordinary room conversation about matters having nothing to do with her otic trouble. Suspecting a psychosomatic factor to be responsible for the results indicated by her responses to sound symbols heard in audiometric tests in a soundproof room, I submitted her to the listening test with the Landis speech reception machine. The result is detailed in Table 37. On the 1949 response, there was good listening and good reporting of conversation at the 15-decibel level of amplification. This was a day when the hearing losses had begun to show an improvement on audiometric tests. At her visit in July 1949, the audiometric tests showed a greater hearing loss. Tests with the Landis machine nevertheless showed an almost normal listening faculty, amplification of only 5 decibels being required to procure perfect responses.

Hence the psychosomatic factor was further investigated, and presently the girl told me what was troubling her. Conference with her parents informed them of the matters at issue.

On the other hand, her blood chemical examination resulted in interesting data (see Table 38).

In discussing Case 22, I alluded to the presence of hypoglycemia in some of my cases in which psychogenic elements entered into the clinical picture. These elements almost always appeared in cases in which dizziness of degrees varying up to actual vertigo with nystagmus were presented. In this case, in which no hypoglycemia was present, it was not to be expected that so young a patient should exhibit vertigo, but the psychogenic element was conceded by herself. Older persons—women who are in the postmenopausal phase of life and men in the stage analogous to the menopause—whose nervous systems are subject to unusual stresses and strains in either business or social relations, and who seem unable to adjust themselves to these strains, often show hypoglycemia on biochemical examination of the blood. In the very young child (under 5 years of age) hypoglycemia is usually coincidental with apathy in cerebration. Children so affected learn poorly, are inattentive, lack concentration and are difficult to keep at assigned tasks. It is not so much that they break discipline as that they appear unable to comprehend its meaning.

On the other hand, the blood of this patient (F.C.) exhibited a normal sugar content. In the face of her psychosomatic symptoms this was comprehensible because of the element of excitement in her condition. Excitement of her nervous system excited the anterior lobe of the

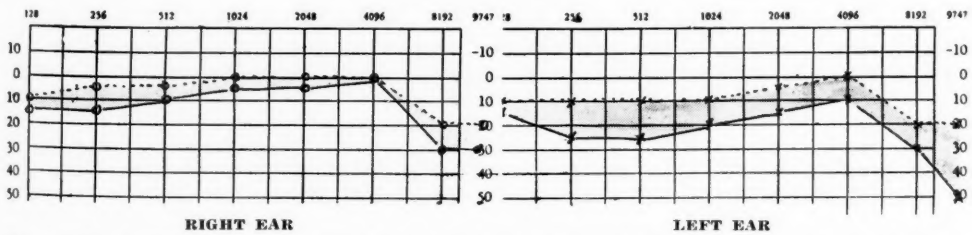

Fig. 15.—Case of R. T., aged 12, as observed from December 1947 to April 1949. Solid line, first test; dotted line, second test; shaded area, gain in decibels.

TABLE 39.—*Hearing Losses in Case 27*

Date	Whole range loss, %		Speech range loss, %		Binaural loss, %	Condition of ossicles	
	Right ear	Left ear	Right ear	Left ear		Right ear	Left ear
12/26/47	12	21	5	16	8	Mobile	Impeded
6/25/48	10	18	3	13	4	Mobile	Impeded
9/10/48	11	12	3	11	0.3	Mobile	Impeded
10/30/48	11	11	3	8	0.3	Mobile	Impeded
12/17/48	11	12	3	7	0.3	Mobile	Impeded
1/21/49	9	9	3	7	0.2	Mobile	Impeded
4/ 1/49	6	9	0	7		Mobile	Impeded

pituitary gland, with a resultant increase in secretion of epinephrine. This produced a reaction in the carbohydrate metabolism, especially as it applies to glucose. The other items that deserve consideration when the two hematologic reports are studied are (1) the history of deafness in the father's and the grandmother's family and (2) the presence of hyperpyruvemia noted at both examinations, with hypercholesterolemia also present at the second.

The otoscopic observation of impeded mobility of the ossicular chain in the left ear, and the fork tests, which exhibited prolonged bone conduction, taken in consideration of the fact that between July 22, 1948, and July 11, 1949, hypercholesterolemia developed in a case in which there was a family heritage of deafness and in which one ear already showed an impeded ossicular chain made it seem justifiable to classify the case as one of otosclerosis with superimposed psychogenic factors.

Corrective diet and medication have been instituted. Future developments will be checked and reported as occasion presents itself. The case is recorded here because of the conflicting picture it presents, both clinically and upon tests.

Case 27: R. T., a boy aged 12 years, complained of crackling sounds in his left ear on yawning. He was tested in school and was found to have a loss of hearing. There was no deafness in the family. He had had discharging ears at the age of 1 year. This had cleared up. He was subject to frequent colds.

Physical examination revealed a high deflection of the nasal septum, with a spur on the left side. The tonsils had been removed. There was a whitish postnasal drip. In the right ear cerumen was present. The posterior segment showed a healed perforation, and that part was movable. The ossicles were movable. The vascular reflex was moderately prompt. In the left ear the posterior segment was most movable. The ossicles were much impeded. The drum was bound down by adhesions.

The earliest and the most recent audiograms are charted in Figure 15. There was shortened bone conduction but no raised lower tone limit. There was no positive family history of deafness. A summation of the hearing losses is given in Table 39.

The blood biochemical data are shown in Table 40. The first examination, made in December 1947, showed, among chemical processes out of line, hy-

TABLE 40.—*Biochemical Hematologic Values in Case 27*

Constituent	Normal value	Value in Case 27, 12/29/47	Value in Case 27, 6/11/49
WB—Urea N	12–15	13.6	12.6
WB—Uric acid	2.5–3.5	3.3	3.2
WB—Sugar	80–120	85	113.0
BS—Cholesterol	160–200	250	195.0
BS—Phosphorus	2.4–4.0	4.2	3.55
BS—Calcium	9–11	11.0	10.1
BS—Carotene	115–122	117.3	117.7
BS—Vitamin A	70–197	93.8	99.4
BP—Vitamin B_1	0.6	0.8	0.816
BP—Vitamin C	0.8–2.4	1.2	1.48
BS—Total protein	6.5–8.2	7.8	6.75
BS—Albumin %	4.6–6.7	5.6	4.50
BS—Globulin %	1.2–2.3	2.2	2.25

TABLE 41.—*Comparative Biochemical Hematologic Data on Congenitally Deaf Child and Her Parents*

Constituent	Normal value	Value for child*	Value for father†	Value for mother§
WB—Urea N	12–15	12.1	12.0	13.3
WB—Uric acid	2.5–3.5	2.8	3.7	3.04
WB—Sugar	80–120	85.0	92.5	88.0
BS—Cholesterol	160–200	280	195.0	207.5
BS—Phosphorus	2.5–4.0	5.21	3.47	3.06
BS—Calcium	9–11	9.2	9.9	10.1
BS—Carotene	115–122	118.2	121.6	119.8
BS—Vitamin A	70–197	100.5	103.6	101.3
BP—Vitamin B_1	0.6	1.55	0.7	0.8
BP—Vitamin C	0.8–2.4	1.09	1.45	1.23
BS—Total protein	6.5–8.2	6.50	6.75	6.50
BS—Albumin %	4.6–6.7	4.20	4.35	4.15
BS—Globulin %	1.2–2.3	2.30	2.40	2.35

*P. A. S., girl aged 3 years. Normal high cholesterol level 190 mg. per 100 cc. Gave palpebral reflex only to whistle and tuning fork at concha but did hear sounds. Ossicles movable

†Mr. C. S., aged 41. Unaware of deafness but showed hearing loss at about 12 db. level; had second cousin who was deafened

§Mrs. B. S., aged 36. Unaware of deafness but showed hearing loss at 20 db. level; her father was deafened

percholesterolemia and hyperpyruvemia with an imbalance in the calcium-phosphorus ratio.

Corrective diet and medication aimed at reversal of the chemical processes at fault were instituted. Examination of the blood six months later revealed (1) a normal cholesterol content and (2) persistent hyperpyruvemia. The functional improvement in the cochlear mechanism was shown in the improved hearing acuity at the last test. This patient too is still under observation to determine whether medication should be continued. Replacement therapy to supply deficient items of the vitamin B group is under way.

Case 28: P. A. S., a girl aged 3 years, had a positive family history of deafness. Her parents reported that the child's grandfather on the father's side and a second cousin on the mother's side were deafened. The parents themselves were, however, unaware of being deafened. The mother had occasional dizzy spells, which she ascribed to "nervousness."

Biochemical examination of the child's blood revealed hypercholesterolemia and a high degree of hyperpyruvemia (Table 41). I requested that studies be made of both parents' blood, and this was done. Although the father had no hypercholesterolemia, he did have hyperpyruvemia, and the mother presented both hypercholesterolemia and hyperpyruvemia.

Hearing tests of the parents revealed deafness in both, but no loss below the 30-decibel level. Hence their unawareness of their hearing disability was comprehensible.

The father showed a hearing loss for the whole range of hearing of 20.5 per cent in the right ear and 18.4 per cent in the left ear. Bone conduction tests taken under conditions of masking showed a progressive loss in the right ear at each frequency cycle band above 512, with no response at all above 4096 frequency p. c.; the left dropped also from normal at 512 to the 30-decibel level at 8192. The tuning fork tests revealed an acoustic nerve type of deafness, the factor at fault being a deficiency in the diphosphothiamine-magnesium-protein item of the so-called vitamin B group.

The mother's hearing losses were less than her husband's. She had a whole range loss of only 10.8 per cent in the right ear and 9.25 per cent in the left ear. The masked audiometric tests for bone conduction revealed a slight drop in the high note ranges to the 20-decibel level, in contrast with the losses in the low notes to the 25-decibel level in air conduction tests.

In Case 27, as in others I have studied, I cannot escape the implication of hypercholesterolemia combined with hyperpyruvemia. When I remember my early studies of otosclerosis, and reports in the literature of the accidental discovery at autopsy of otosclerotic bone lesions in persons who were asymptomatic as far as hearing loss was concerned, I cannot avoid thinking that this woman may have asymptomatic otosclerosis, which may eventually produce definite lesions on the otic

capsule and become symptomatic. Her vague story of dizziness, indicating vestibular dysfunction, supports the presumption. I had no chance to make an otoscopic examination of either this woman or her husband. They were concerned only with their child's condition.

For the child, educational matters have been arranged and therapy aimed at reversal of abnormal chemical processes has been started.

THERAPY

The therapist must comprehend clearly the wide range of lesions, endocrinopathies, and even mild neurologic and psychogenic conditions from which the three symptoms deafness, tinnitus and vertigo make their onset. Not only must therapy aim at handling deafness, tinnitus and vertigo but, if at all possible, there must be diagnostic differentiation of the *origins* of these symptoms. It is necessary to determine whether they arise from diverse pathologic conditions *as a secondary symptomatic manifestation* or whether they originate from a condition strictly within the anatomic boundaries of the acoustic and equilibrial apparatuses as an initial, *primary* effect of a systemic enzymatic dysfunction, presenting primary symptoms referable to dysfunctions of the cochlear and the vestibular mechanism.

The otologic therapist must also realize that, in most of the conditions he meets clinically, the results of therapy do not appear with dramatic suddenness. Good results are obtained slowly over a long period. *If the trend toward further deterioration is halted within three months,* continuation of therapy is justified by the favorable prognosis which such a halt in hearing losses, previously progressive, warrants.

The therapeutic needs are twofold:

1. To correct the *subclinical hypothyroidism* so often present (as it was in the majority of my own cases). This calls for therapy to enhance the functional activity of the thyroid gland in its relations to the anterior lobe of the pituitary gland and in its trophic elements as they affect the visceral organs and glands and their internal secretions—and not only the visceral glands and organs but the interplay of the sympathetic and parasympathetic nervous systems, as it affects them must be considered, particularly as regards the cochlear and vestibular mechanisms.

2. To correct *hypersensitivity to histamine*, which, in a very large number of cases studied, was discovered by specific tests.

Few patients show the stigmas of thyroid dysfunction, yet most of them are subclinically hypothyroid. When tested they show a low metabolic rate; also, they are aware of improvement and a feeling of well-being after the administration of thyroid extract in appropriate doses, the dosage being determined by the necessities of the given case.[10] While the other factors at fault (to be discussed later) are being medically treated, it will, as a rule, produce better therapeutic results if thyroid extract is administered with the other medication to be described.

At monthly intervals one intramuscular injection of anterior pituitary extract is very helpful.

The desensitization of the patient who is hypersensitive to histamine is an immunization procedure. This should be started by injection of very small doses of histamine solution until desensitization has been completed. Thereafter a maintenance dose should be given approximately every three weeks to keep the patient immunized. The results are highly satisfactory. So-called "head colds" and "sinus trouble" that have seemed intractable in some patients will disappear. Indirectly, too, the immunization procedure is often effective in inducing a more nearly normal function of the anterior lobe of the thalamus in its regulatory mechanisms of subconscious reaction to deleterious environmental agents. In the desensitized patient, the regulatory mechanisms initiated by histamine hypersensitivity are brought to rest and recuperation. Indirectly this also improves the water, protein and carbohydrate metabolic processes, all of which, in addition to synchronization of the sympathetic and parasympathetic systems, have control centers located in the same general thalamic area.

Since most allergies occur with a background of calcium deficiency, the oral administration of calcium products enhances the effects of desensitization procedure.

Every other lesion and condition—cardiovascular disease; diabetes; trends toward the

development of hepatic cirrhosis; dysfunctions of the gallbladder; gonadal aberrations, and psychosomatic ailments—must be brought under medical control and therapy in cooperation with the family physician. This is particularly important when the cochlear and vestibular dysfunctions, stemming from any one of these conditions, produce otic symptoms as secondary manifestations.

Finally, there are the *primary dysfunctions* of the cochlear and vestibular mechanism, including those incidental to the heritage of deafness which appears in blood relatives of some patients, including the congenitally deafened. In these cases biochemical examination of the blood reveals hyperpyruvemia and hypercholesterolemia. In many instances in which repeated hematologic studies have been made, hyperpyruvemia preceded hypercholesterolemia in the same patient. This was an invariable observation in those cases in which the condition had progressed and a greater deterioration of hearing was evidenced at audiometric examinations subsequent to the first functional and hematologic study, in which, though hyperpyruvemia was noted, cholesterol levels were normal. Obviously, when the applied therapy was successful and the hearing loss was halted or the hearing improved, no secondary studies of the blood were made in the majority of cases. When further hearing losses were evident on functional examination, the blood studies were repeated, and the presence of hypercholesterolemia was usually coincidental with the greater deterioration of cochlear function. In the congenitally deaf, even in the very youngest patient, both hyperpyruvemia and hypercholesterolemia were always present.

The initial observation of hyperpyruvemia with subsequent deterioration of the patient's clinical and functional health is comprehensible when it is realized that the carbohydrate metabolism shows dysfunction first. Only when protein metabolism becomes secondarily involved does hypercholesterolemia become evident.

A brief survey is necessary for appreciation of the significance of these pertinent excesses in the blood as they are related to disturbed metabolism, and particularly of the manner in which this disturbance of metabolism produces dysfunctions in the cochlear and vestibular mechanism. It is necessary because, once the successive steps in dysfunction associated with hyperpyruvemia and hypercholesterolemia are clearly comprehended, these hematologic abnormalities in themselves almost suggest the rational approach to effective therapy.

How does hyperpyruvemia affect the acoustic and vestibular mechanisms? The pyruvic acid in the blood is here used as an indicator of the blood level of the so-called vitamin B_1. Employment of the term B_1 is a concession to common usage. It is not, however, correct. The *enzyme* responsible for the decarboxylation of pyruvic acid is actually not thiamine, but *diphosphothiamine-magnesium-protein.* This is a carboxylase. In a recent publication[9] I explained that in using the pyruvic acid levels as indicators of a deficiency in the so-called vitamin B_1 I was using fractions as compared with normal values. The values noted are to be interpreted as indicating *subclinical* deficiencies of this enzyme. Vitamin B_1 is essentially concerned with metabolic processes, particularly carbohydrate metabolism. According to the view most generally accepted, it acts as a catalytic co-enzyme prosthetic group in the enzyme system of carbohydrate metabolism. *Its specific property is the maintenance of normal nerve function.* Physiologists also assign to it the function of controlling and inhibiting the overactivity of cholinesterase. Wiggers[11] has stated that nerve fibers, particularly at their terminals, release a chemical substance, acetycholine. Acetycholine is the transmitting agent which, in cases like those here studied, must be present at the acoustic and vestibular nerve terminals as well as at nerve synapses along the neural tracts, so that transmission of the nerve impulse may proceed physiologically. When the enzyme is deficient, as indicated by hyperpyruvemia, control over cholinesterase is handicapped or lost; the uncontrolled action of cholinesterase destroys the chemical mediator, acetycholine, and transfer of the energy of the sound wave pattern along the nerve tracts, particularly at the various synapses, is handicapped and hindered. This deficiency is also evident at the nerve end plates innervating the stapedius and the tensor tympani muscles, revealing itself

particularly as the factor at fault in the spasmophilic type of otosclerosis.

Deficiency in so-called vitamin B_1 when associated with symptoms of dysfunction in the cochlear or the vestibular mechanism, requires replacement medication to supply the deficiency. Such medication must be continued as long as the deficiency exists, the blood level of pyruvic acid being used as indicator.*

Therapy based entirely upon the oral replacement of thiamine was found unavailing. It failed to secure improved hearing results. Thiamine combined with other components of the vitamin B complex gave better results both clinically and functionally. Finally, when trace metals and amino acids were added, the best clinical and functional results were obtained. Thus B_2 (riboflavin), B_6 (pyridoxin), nicotinic acid, the P-P factor, pantothenic acid, or the filtrate factor biotin and p-aminobenzoic acid, folic acid, and a number of less well characterized vitamins were assembled. In the early cases I used a preparation that required two tablets given every three hours daily. This was a handicap to the patient; later, therefore, I substituted another preparation,† which required that only one tablet be taken three times a day. I have been using the latter tablets since their appearance on the market, with very satisfactory results in functional hearing and in the general clinical picture.

Physiologists have shown that excessive cholesterol handicaps the oxidation processes of the body. When the carbohydrate metabolism is faulty, faulty fat metabolism[12] inevitably ensues. The aforementioned deficiency in the trend toward avitaminosis in the vitamin B group affects also the lipoids of the nerve sheaths, adding a factor toward demyelination and nerve degeneration, and the faulty fat metabolism consequent to carbohydrate metabolic faults causes a deficiency in the lipotropic factors,[12] which results in lipoid deposits in the endothelial layers of arterioles and capillaries. In the smaller blood vessels of the cochlear and vestibular apparatuses, narrowing of the lumen results in blood stasis and lack of oxygenation of the parts, and is the factor incidental to changes in the tissue cells supplied by these vessels.

In this connection it may be interesting to recall Wittmaack's experimental work on poultry,[13] in which the experimental chick was subjected to induced blood stasis of the auditory and vestibular apparatuses in an endeavor to find the initial causative factor in the evolution of the cellular pathologic picture of experimentally induced otosclerotic lesions. Wittmaack never experimentally produced the osseous lesions of otosclerosis, but he did show experimentally produced changes in the end organs of the cochlear and vestibular nerves, due to blood stasis. I do not doubt that absence of lipotropic factors and deposits of lipoids in the arterioles and capillaries of the cochlear and vestibular mechanisms produce a similar blood stasis.

For some time the only medication I used was a corrective diet, bland and fat free, with increased proteins and easily assimilated carbohydrates. In addition, because cholesterol is assumed to be controlled by administration of bile salts, a small dose (approximately 2 gr.) of bile salts* was administered once a day, half an hour after the patient's principal meal.

Recently there has appeared upon the market a preparation that appears better to fulfill the requirements of a more purposeful therapy. Since the endothelial lining of the arterioles and capillaries has lipoid deposits, the therapy now used in conjunction with that cited above to handle the hyperpyruvemia, will tend to correct the faulty fat metabolism by applying lipotropic factors but will cause re absorption of lipoid deposits in the lining membranes—the endothelial lining of the blood vessels. The newer drug† supplies choline

*The laboratory work for this study was done in the Molnar Laboratories and under the supervision of Mr. Nicholas M. Molnar, Fellow of the American Institute of Chemists. The test methods used were those of Friedman and Hangan (J. Biochem. **147**:415, 1943). Another method was described by G. D. Lu (ibid. **33**:249, 1939). In principle, the two methods are similar. Great care must be exercised in distillation and the pressure under which the reagent is distilled. The reading must be taken after the last reduction process, at the end of ten minutes; if it were taken immediately, false values would be obtained. The patient should be completely relaxed and rested before the blood specimen is taken; otherwise, higher values due to exercise might cloud the pathologic picture.

†Betazyme Tablets, distributed by Barrows Chemical Co., New York.

*Desicol capsules, distributed by Parke, Davis and Co.

†Tablets Lipozyme, distributed by Barrows Chemical Co., New York.

methionine and inositol, each of which has a beneficial action on the fat metabolism. The tablets contain large doses (choline dihydrogen citrate, 450 mg.; dextro-laevo methionine, 225 mg., and inositol, 225 mg.).

In addition to other medication, in all cases, thyroid extract in small doses is given once daily. Once a month an intramuscular injection of anterior pituitary extract* is administered.

When the history or the symptom complex indicates a deficiency in sex hormones, these should be administered additionally.

It must be remembered that most of these patients have multiple needs as far as therapy is concerned. No routine set therapy will ever be successful. The physician is dealing with groups of symptoms that vary considerably from the individual patient's standpoint. Each case usually presents more than one facet, to handle which broad clinical experience is as necessary as is the specific knowledge required for the specialist's practice of otology.

SUMMARY

The author presents a study of 581 cases of deafness of all types, which demonstrated the wide range of bodily diseases and dysfunctions from which deafness, tinnitus and vertigo originate.

Biochemical examinations of the blood in the vast majority of cases revealed hyperpyruvemia and hypercholesterolemia. These conditions were present even in infants below 2 years of age, and tests of blood relatives who were deafened gave similar results. The blood values of congenitally deaf children were similar to those of the parent who carried the heritage of deafness, although in some instances the parent was symptom-free so far as the acoustic or the vestibular apparatus was concerned. It is suggested that in some instances a parent with the heritage of deafness who has no dysfunction of the cochlear or the vestibular apparatus may nevertheless have asymptomatic otosclerosis.

A method of therapy is indicated that replaces deficient enzymatic elements and thus aids the return to normal carbohydrate metabolism, which in itself would aid fat metabolism. In addition, lipotropic factors are administered to reduce the excess of cholesterol in the blood and remove the lipoid deposits in the endothelial linings of the arteries and capillaries. A suitable dietary regime is prescribed. All these therapeutic measures are directed toward causing a reversal of the biochemical processes at fault in cases of this kind.

RÉSUMÉ

L'auteur présente une étude portant sur 581 cas de surdités de toutes catégories qui montre le grand nombre d'affections corporelles et de troubles fonctionnels provoquant la surdité, le tintement et le vertige.

L'examen biochimique du sang dans la plupart des cas révéla une hyperpyruvémie et une hypercholestérolémie. On retrouva ces conditions même chez des enfants au dessus de 2 ans, et les examens de sang des parents qui étaient sourds donnaient des résultats semblables. Les valvules sanguines des enfants atteints de surdité congénitale sont semblables à celles des parents porteurs de l'héritage de surdité, bien que dans quelques cas les parents ne présentent pas de symptômes tant que l'appareil auditif et vestibulaire n'est pas atteint. On pense que, dans quelques cas, un parent portant l'héritage de surdité et qui n'a pas de trouble de l'appariel cochleaire ou vestibulaire peut néanmoins avoir une otoselérose asymptômatique.

La méthode thérapeutique indiquée est celle qui remplace les éléments enzymatiques insuffisants et ainsi aide au retour du métabolisme normal des hydrates de carbone qui lui-même aidera au métabolisme des graisses. De plus, des facteurs lipotropiques sont donnés au malade pour réduire l'excès de cholestérol dans le sang et pour enlever le dépôt lipoïde sur le tissu endothélial des artères et des capillaires. Un régime diététique approprié est prescrit. Toutes ces mesures thérapeutiques sont employées pour obtenir un renversement du processus biochimique dans cette catégorie de cas.

*Proloid Tablets, distributed by the Maltine Co., New York. Ampules, Anterior Pituitary Extract, distributed by Armour and Co., Chicago.

RIASSUNTO

Passa in esame 581 casi di sordita' di tutti i tipi onde dimostrare quanto vasto sia il campo delle malattie e delle disfunzioni capaci di causare sordita', tinnito e vertigine.

Nella maggioranza dei casi l'esame del sangue rivela un'ipercolesterinenia ed un iperpiruvemia. Queste deviazioni biochimiche figurano anche in bambini al disotto dei due anni: e per di piu', nei genitori affetti dallo stesso tipo di sordita'. Nei casi di sordita' congenita, le valvole del sistema circolatorio sono simili a quelle dei genitori, anche se questi non presentano sempre sintomi riferibili all'apparato acustico o vestibolare. L'A. suppone che l'influenza ereditaria sia presente anche se i genitori non rivelano disfunzioni cocleari o anomalie vestibolari: al loro posto si potrebbe sostituire un'otosclerosi asintomatica. In taluni casi l'A. propone una terapia destinata a supplire alla deficienza di taluni enzimi. Quando il metabolismo dei carboidrati e' disturbato, puo' essere indicata la somministrazione di fermenti atti a scindere gli idrati di carbonio, aiutando in tal modo anche il ricambio dei grassi. I fermenti lipolitici possono ridurre l'eccesso di colesterina nel sangue e rimuovere i depositi di lipoidi nelle cellule endoteliali dei vasi. Oltre a cio', una dieta appropriata puo' riuscire utile.

Da questo studio sembra risultare che la terapia deve rivolgersi—nei casi in cui gli esami biochimici dimostrano delle anomalie nel metabolismo dei grassi o degli idrati di carbonio—a riequilibrare il ricambio di queste sostanze, domostrando ancora una volta la complessita' delle cause che influiscono sopra la sordita'.

SUMARIO

El autor presenta su estudio de 581 casos de sordera de diferentes tipos, los que demuestran la gran variedad de los factores etiológicos productores de la sordera, del tinito y del vértigo.

Los exámenes bio-químicos de la sangre han revelado, en la gran mayoría de los casos, un incremento de la tara del ácido pirúvico y de la colesterina. Esta alteración bio-química se ha encontrado aún en casos de infantes de menos de 2 años de edad, y es interesante el hecho de que relacionados de estos infantes tambien presentaron esta misma alteración de su quimismo, cuando sufrían de sordera. En general la similaridad de estas alteraciones del quimismo del suero entre el niño y el padre que transmite la herencia de la sordera, se encuentra aún en casos en que dicho padre no revela disfunciones del aparato vestibular o del sonido. Esto sugiere la existencia de otoesclerosis asintomática en estos padres.

Se ha indicado un método terapéutico que corrige la deficiencia catalí tica existente del metabolismo de los hidrocarbonados, y su influencia en el de las grasas. En adición se administran factores lipotrópicos con el objeto de reducir la colesterina de la sangre y favorecer la reabsorción de los depósitos abnormales de lipoides en el endotelio de las arterias y capilares sanguíneos. También se ha recomendado un régimen dietético. Todas estas medidas terapéuticas tienden a la corrección de los procesos bioquímicos alterados por la enfermedad.

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Surgical Management of Malignant Lesions of the Colon

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SURGICAL treatment of malignant lesions of the colon is largely a matter of preparation and of selecting a suitable procedure. All surgeons agree as to the necessity of adequate and painstaking preoperative preparation. There is, however, some honest difference of opinion concerning the most effective surgical procedure, owing chiefly to the individual surgeon's early training and his familiarity with certain methods of approach.

The exteriorization procedure introduced by Mikuliez and standardized and popularized by Rankin and Lahey is effective and sufficiently extensive. It has a wide range of usefulness. It has disadvantages for the obese patient and for the patient with a short mesentery. The principle of resection and primary anastomosis emphasized by Halsted and his followers has a wide appeal and is being more frequently and successfully employed. It is in reality an attempt to reduce the necessity for secondary operation, to remove a larger amount of gland-bearing tissue and to avoid creating a temporary or a permanent colostomy.

Both groups have contributed much to the advancement of surgery of the colon, and their friendly rivalry has stimulated each to greater endeavor. I believe, however, that there is a field of usefulness for each method and that careful individualization determines the most suitable procedure.

Fundamental knowledge of the embryology, anatomy and physiology of the colon is essential to comprehension of the physical characteristics of malignant lesions and to understanding of the symptomatic sequence resulting from them. Acquaintance with the anatomic structure and its concomitant blood supply is necessary for successful surgical removal of these lesions and for reconstruction of the bowel.

The small intestines and the right side of the colon are derived from the midgut and have assumed their normal position by proper and timely rotation. The lymphatic drainage of the right side of the colon extends from the terminal portion of the ileum to beyond the hepatic flexure, converging at a point near the superior mesenteric artery. Therefore, segmental resection of the right side of the colon is inadequate, because not all the gland-bearing tissue is removed.

The blood supply is from the same artery, the superior mesenteric. This actually forms a sharp line of vascular demarcation at the middle or distal portion of the transverse part of the colon, as was demonstrated recently in a case of complete thrombosis of the stem of the superior mesenteric artery. The entire small intestine tract and the right side of the colon up to a definite line of demarcation in the mid-portion of the transverse colon were black and devitalized.

The left transverse colon and the left colon originate from the hindgut and are supplied by the inferior mesenteric artery. Recognition of this vascular distribution is essential to colonic surgery, and extreme care must be exercised in all colonic reconstructions to assure an adequate blood supply at the site of anastomosis. A good arc must be preserved, and no compromise can be tolerated.

The right side of the colon differs anatomically from the left. The cecum has a very thin muscular wall and is capable of extreme distention; progressing distally, the muscular coat gradually becomes more pronounced until the left side is reached. The right side of the colon is larger than the left, and its lumen is greater; the fluid content is semiliquid, and the bowel has the physiologic properties of fluid absorption. In some measure it has many of the physiologic characteristics of the small bowel.

The left side of the colon progressively becomes a cylindric tube for the collection of

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residue and has few of the physiologic properties of the right colon. However, in the absence of the right portion it does have the property of adapting itself to some degree of fluid absorption. It is largely a tubular structure for the storage of debris. It has strong cylindric and longitudinal muscles, adapted for forceful peristalsis and expulsion of contents.

Lesions of these two structures, therefore, are anatomically and fundamentally different; they could hardly be otherwise. A lesion of the cecum could hardly grow around the bowel as it does on the left and produce an annular constriction. The symptoms of cancer of the colon, therefore, varies as to the location of the lesion. They are essentially as follows: change in bowel habits, passing of frequent stools with blood and mucus; bright red blood; change in caliber of the stool, or pregressive bowel constriction with ultimate obstruction.

Obstructive lesions act symptomatically like obstructive lesions of the small bowel. The pain is periodic, increases in severity and ends abruptly in a climax of pain, only to recur shortly. Peristalsis may be noted if the abdominal wall is thin and not obese. Borborygmus is distinctive by its metallic sound; it occurs synchronously with the abdominal colic. Tenderness rarely develops with distention of the proximal portion of the colon. This distention is significant of pending rupture at the most distendable portion of the colon, the cecum. In this it is like strangulated obstruction of the small bowel. The abdomen is not distended symmetrically. The distended cecum may be seen and mapped out. The roentgenogram shows the distended bowel identified by position and haustral markings. An enema of thin barium shows the site of the obstruction.

Nonobstructive lesions show characteristic patterns when tested by barium enema, depending upon the nature and size of the lesion. They are essentially defects in the bowel contour, annularity or canalization. Defects in bowel regularity result from ingrowing lesions, and annularity or canalization from constricting and infiltrating lesions.

Segmental study of lesions of the colon will reveal the characteristic differences. Lesions of the right side of the colon grow well out into the bowel lumen and produce large ulcerating fungating growths which ooze, bleed and become secondarily infected. Hence there is profound anemia, resulting from the passage of blood and mucus by frequent stools. The lemon-colored appearance of cachexia often develops. If this is observed to be associated with lesions of the left side of the colon it indicates great extension and probably inoperability. Here it is due to the ulcerated and hemorrhagic nature of the lesion and the associated secondary infection. Many glands may be present and be benign because of this associated infection. Inflammatory reaction and edema may preclude primary resection. In spite of the extreme anemia and cachexia, rehabilitation can be effected by adequate blood transfusions so that exploration can be safely accomplished.

Lesions at the hepatic flexure rarely grow around the bowel and produce annular constriction, but they do, by growth, angulate the bowel and produce obstruction. They likewise infiltrate the bowel wall, become fixed posteriorly and laterally by neoplastic extension or inflammation and produce stasis or complete obstruction. True obstructive lesions in the ascending colon and hepatic flexure are usually inoperable because of malignant extension or extensive mesenteric metastasis. Often edema, inflammation or abscess formation is a complicating factor, distinguishable with difficulty from retrocecal appendical abscess, diverticulitis, tuberculosis or perforating cancer. Ileocolostomy adequately detours the intestinal current, so that obstruction, inflammation and associated inflammatory fixation subside. External drainage of the bowel is not necessary.

An end-to-side ileocolostomy may be done, with closure of the distal end of the ileum, if obstruction is not present. If obstruction is present this procedure cannot be done, but a simple side-to-side ileocolostomy will suffice. Care must be taken to prevent any residual opening between the mesentery of the ileum and that of the transverse colon through which small bowel might pass and obstruct. I have seen such an obstruction.

The essentials of resection and primary anastomosis are uncompromising and definite. They are as described by Reichel.

1. The patient must be in condition to withstand a more lengthy operation.
2. There must be no obstruction; the

proximal bowel must be clean and harbor no accumulated fecal material.

3. The bowel must be viable and the blood supply unimpaired.

4. There must be no tension on the suture line.

Extirpation of lesions of the right colon, even though small, must be extensive because of glandular drainage toward the region of the mesentery. I always remove the entire right colon and up to or beyond the midcolic artery of the transverse colon and preferably do an end-to-side ileocolostomy. I prefer this type of anastomosis because it anatomically approaches the normal ileocecal relationship. Also it necessitates only one blind closed end of bowel, whereas with a side-to-side anastomosis there are two, with two pouches that may become distended with accumulated contents. I have operated upon one enterocele of the blind end of the ileum after an anastomosis of this type. The end-to-end anastomosis presents difficulties due to caliber variation. I consider it inadvisable, though I have done it occasionally.

It is rarely necessary to do a two-stage procedure for lesions of the right colon. I have extended my approach to this problem and now accept for primary resection lesions for which I formerly did a preliminary ileocolostomy. I believe this is due to better preoperative preparation of the patient; cleansing of the bowel, intestinal intubation, blood transfusions, antibiotics and a better technical approach. Technical dexterity is essential; without it a promising condition may end in disaster. I have seen this occur. Technical skill and good surgical judgment come only with experience and are too often gained at the price of many mistakes.

In 27 consecutive right colectomies for malignant lesions I have done no preliminary ileocolostomy. There were no deaths. There were 3 moderately fixed lesions, 1 of which required removal of a portion of the parietal peritoneum and the underlying muscles. In a preceding small series there was one preliminary ileocolostomy deemed necessary because of infection, edema and fixation, which was subsequently resected.

Obstructive lesions of the transverse should be decompressed by cecostomy and later resected, bowel continuity being reestablished by end-to-end anastomosis. Resection and primary union should never be attempted in the presence of even a slight obstruction, as contamination of the proximal bowel and caliber dimensions preclude success. The maximum of primary colonic surgery is an absolutely nonobstructive clean bowel, and this is uncompromising. If the bowel is scrupulously clean, open anastomosis can be done safely with a mortality no greater than with the closed type of anastomosis or the obstructive type of Mikulicz resection.

It cannot be too strongly emphasized that the most important feature of any primary bowel resection and anastomosis is that an adequate and unimpaired blood supply be maintained. A clean bowel and accurate suture approximation are essential but without blood supply they avail nothing. A free and abundant blood supply can compensate to some extent for other inadequacies, but no amount of meticulous care can compensate for blood deficiency. All factors must be favorable for successful primary colonic resection and anastomosis. Obstruction, fixation and infection are distinct contraindications. Obstruction itself badly damages the consistency, tone and viability of the bowel wall. An edematous, hypertrophied bowel cannot be securely anastomosed.

Sulfa medication is unquestionably helpful but is ineffective in an unclean bowel. I clean the bowel thoroughly, give sulfasuccidine or sulfa thialadine for five to seven days and administer 2 to 4 Gm. of streptomycin two days prior to operation.

Fixation definitely affects the thoroughness and safety of mobilization, and adjacent structures may be seriously damaged in the process. The problem of infection, perforation or abscess formation adds to the danger of local contamination and dissemination of infection.

SPLENIC FLEXURE

Lesions of the splenic flexure are usually of a slow progressive obstructive type, and the early symptoms are referred to other parts of the gastrointestinal tract, remote from the primary lesion; therefore the diagnosis is rarely made until obstruction occurs. The lesion is high under the costal arch and is not palpable

until it reaches a considerable size. The proximal limb of the splenic flexure is often superimposed upon the distal limb, and an anterior-posterior view after a barium enema may be misleading and reveal no lesion, while an oblique view may show a definite defect. Abscess, perforation and fixation are common. Surgical approach is difficult anatomically, especially if the patient is obese. Moderate obstruction is frequently present and preliminary cecostomy is necessary. Because of the difficulty of evaluating the local situation in lesions of the splenic flexure, proximal colonic drainage (cecostomy before resection and primary anastomosis is not to be condemned. A moderate obstruction is best handled by an obstructive Mikulicz type of procedure with subsequent closure and not by resection and primary anastomosis. Resection of a wide segment of the mesentery is essential, and removal of glands deep in the abdomen must be carefully done lest vascular damage be inflicted on major vessels.

DESCENDING COLON AND SIGMOID

Lesions in these areas of the colon are usually annular and more or less constrictive. When first observed they show varying degrees of obstruction, from chronic subclinical to complete. Fortunately, most apparent obstructions are not complete neoplastic closures but are in part due to edema, inflammatory reaction and the invagination of mucous membrane into the meager neoplastic lumen. With proper surgical decompression and irrigations they relent sufficiently so that a clean bowel can be obtained and resection and anastomosis done with safety. Proximal surgical decompression can be done by cecostomy or by colostomy of the transverse colon, the latter being preferable. However, in cases of complete obstruction with extensive proximal bowel distention this is not always easy. Often the distended right transverse colon is forced high under the liver by the enormously distended cecum, which pushes everything well toward the midline and upward, so that the transverse colon is unapproachable. In surgical decompression I have found it often better to deflate the cecum by needle puncture and aspiration and insert a tube, or to exteriorize a small segment, than to attempt isolation of an inaccessible distended transverse colon. True, it is harder to cleanse the colon of its accumulated contents after a cecostomy than after a transverse colostomy, but it is often safer when the bowel wall is enormously dilated and paper thin. The danger of rupture is too great to permit manipulation. The bowel can be cleansed successfully through a cecostomy, and it can also be satisfactorily decompressed, although it may take longer. Complementary cecostomy or colostomy accompanying resection and primary anastomosis of the left colon or the sigmoid flexure is not to be condemned. It is commonly practiced by many capable surgeons. It provides a vent for accumulated gas and prevents tension on the suture line. The subsequent closure is a small procedure. The added security is well worth the minor inconvenience.

The point of greatest clinical interest is that colonic obstruction is a closed loop obstruction and is subject to gangrene and perforation when the intracolonic pressure equals or exceeds the systolic blood pressure. No blood can then reach the antemesenteric portion of the distended cecum, and localized gangrene and rupture develop. I have observed this twice. In 1 case it developed during preparation for cecostomy. The cecostomy, however, was immediately carried out, and fortunately there was little abdominal soiling from the disseminated gas. Recovery occurred, and subsequent resection of the lesion was successfully done. Colon obstruction is comparable to strangulated obstruction of the small bowel, as no bowel contents flow back into the terminal part of the ileum and the blood supply ultimately becomes obstructed. Therefore, surgical decompression should not be long deferred lest gangrene and rupture of the cecum take place.

RECTOSIGMOID

As has been mentioned by Gilchrist and David, the anatomic classification of the rectum, rectosigmoid and lower sigmoid is not very clear. The rectosigmoid is hard to define. The excised specimen shows no such anatomic structure. These authors describe that portion below the pelvic peritoneum as "extraperitoneal carcinoma" of the rectum and that

above and below the promitory of the sacrum as "intraperitoneal carcinoma."

The lesions are constrictive and frequently obstructive, requiring colostomy as a preliminary procedure, preferably of the right transverse colon. Subsequently the anterior type of resection can be done if local conditions are favorable. If the lesion is large or fixed, or if metastatic glands are observed, abdominoperineal resection offers the best chance of removing the involved tissue.

Lesions below the pelvic peritoneum are often not suitable for excision and bowel reconstruction. The problem always is, can all of the cancer be removed and can two ends of the bowel be sewed together successfully? This has been emphasized by Gilchrist and David. Large tumors with involved lymph nodes and distal metastases may be present but unrecognized. The most radical precedure is advisable and can be anatomically accomplished only by abdominoperineal resection. However, anterior resection and anastomosis has a definite place, and, for lesions at or just below the pelvic peritoneum, wide removal of gland-bearing tissue can be accomplished and sufficient bowel below the lesions removed to assure of retrograde malignant extirpation. I myself am approaching this problem more and more by this procedure. Time, however, will be required to establish its actual merit.

SUMMARY

Malignant lesions of the colon are discussed from the point of view of anatomy, pathology and operative technic. The author stresses the importance of maintaining an adequate blood supply and meticulous surgical technic in the various operations described.

RÉSUMÉ

La discussion porta sur les lésions malignes du colon au point de vue de l'anatomie, de la pathologie, et de la technique opératoire. L'auteur souligne l'importance du maintien d'un apport sanguin proportionné et d'une technique chirurgicale minutieuse dans les diverses opérations décrites.

SUMARIO

Se han discutido las lesiones malignas del colon bajo el punto de vista de la anatomía, de la patológia y de la técnica operatoria. El autor da énfasis a la importancia de mantener una circulación adecuada y del cuidado que se debe de tomar en la ejecución de las diferentes técnicas quirúrgicas que han sido descritas.

RIASSUNTO

Discute i tumori maligni del colon dal punto di vista anatomico, patologico e chirurgico. Sottolinea l'importanza di una tecnica precisa, meticolosa, nell'esecuzione dei vari tipi d'operazione, attribuendo una notevole importanza al mantenimento di un'adeguata vascolarizzazione.

Extrapleural Pneumolysis with Methyl Methacrylate (Lucite) Plombage

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IN 1828, William Carson suggested the first mechanical aid in the treatment of pulmonary tuberculosis, i.e., pneumothorax. In 1882, Forlanin re-suggested its use; his first paper was published in 1892. However, the suggestion was practically lost until 1896, when J. B. Murphy revived it. In 1908 Brauer and Spengler published the results of several years' work, and by 1918 pneumothorax was well recognized. In the meantime, however, a need for other mechanical procedures was seen because of failures in certain pneumothorax procedures. The resultant technics of phrenic paralysis, pnemolysis, thoracoplasty, lobectomy and pneumonectomy were slowly developed.

Thoracic surgery received its greatest stimulus after World War I, when, with certain advances in anesthesia, it was found that surgeons could operate on the chest without having the patient in a pressurized cabinet. Some of the world leaders in this field of surgery were Sturtz, 1911 (phrenic nerve crush); Quincke, 1888; Spengler, 1890, and later, Brauer, Freidrich, and Wilms. Still later, Graham of St. Louis and Dolley of Los Angeles showed the way to successful lobectomy and pneumonectomy.

In 1891, Tuffier introduced extrapleural pneumolysis. His method of holding the space produced by operation was the frequent introduction of air. Sauerbruch, I believe, gives this distinction to Schlange. Since Tuffier's time, surgeons interested in the treatment of pulmonary tuberculosis have been seeking a plombage of nonirritating material to maintain the lung in a collapsed state. The results of plombage with such agents as fat, paraffin, hydrostearolein, rubber, muscle, transplant, air and even gauze have been poor. Paraffin has been used to a greater extent than any other agent. Among the outstanding Europeans who have pioneered in its use are R. Nissen, of the University of Istanbul; Gosta Lundh, of Sweden, and McIndoe, Steele and Alexander, of the University of Michigan.

Nissen, in his review of extrapleural pneumothorax, states that "thoracoplasty and its various modifications and plombage are superior to extrapleural pneumothorax." He lists the following causes of danger in instituting an extrapleural pneumothorax: massive hemorrhage, infection of the exudate in the space, perforations of cavities, and slipping of the paraffin plombage.

Gosta Lundh has reported 37 cases in a ten-year experience with unsatisfactory results in the use of extrapleural pneumothorax and paraffin plombage. He recommends thoracoplasty in stages, combined with temporary plombage as described by Walter Schmidt, as the method of choice.

In 1930, McIndoe, Steele and Alexander, of the University of Michigan, reported their experience with paraffin as a plombage. They were convinced that "extrapleural paraffin pneumolysis is an effective operation and that it is indispensable in certain patients in whom all other surgical procedures are contraindicated." They also expressed the opinion "a considerable operative mortality has been avoided in a group of poor risk patients who would otherwise have been subjected to thoracoplasty."

Others who have written extensively on their use of paraffin as a plombage are Brunner, Kremer, Vidakovits, Sebestyen, Joannides, Minas and Schlack, and A. R. Judd—all with varying degrees of favor or disfavor of the procedure.

Geiler, in 1938, introduced a new plastic material for use in dental prosthesis. Chemically this material is known as methyl methacrylate. It is the result of years of intensive chemical research. For several years prior to 1938 it was used by commercial plastic manufacturing companies and marketed under such

From the Abbott Clinic, Ontario, Calif.

trade names as lucite, plexiglas, vitarilic, etc. Methyl methacrylate is an acrylic resin, chemically compounded under exacting chemical and physical specifications, from acetone, hydrogen, cyanide and methyl alcohol in the presence of sulfuric acid. The polymerized form is a clear, light-weight solid which softens at 105 C. and can easily be molded into any shape. Its tensile strength is an outstanding physical characteristic. Spherical masses 1 inch in diameter are said to withstand 700 to 900 pounds of weight, whereas methyl methacrylate, in the finished form, has a tensile strength of 6,000 to 9,000 pounds per square inch. Chemically it is relatively inert; it is soluble in esters, ketones, chloroform, ethylene, dichloride and strong acids, but is not affected by weak acids or alkalis. It absorbs very little water, does not change its chemical composition and does not appear to deteriorate like other plastic materials which have been implanted in the human body.

The effects of methyl methacrylate used to repair cranial defects in experimental animals were studied by Kleinschmidt in 1940. He found remarkably little inflammatory reaction and no foreign body response like those characteristic of other foreign agents. The results of his work have been confirmed by others. During the first few days the plastic plate is surrounded by a small amount of serum, which rapidly becomes organized, forming a thin film of hyaline connective tissue. Rarely does sufficient serum accumulate around the implant to require aspiration. This fact has been stressed by Gurdjion and his co-workers as well as by Kahn, Woolf and Walker, who have used methyl methacrylate successfully in human cranioplasties. Woolf and Walker describe a patient with an infected wound that cleared up with penicillin and local treatment without removal of the plate. Kahn expressed the opinion that this material is so inert that it may be used in the primary repair of perforating wounds of the head. Spealman, Main, Hoag and Larson, working with experimental animals, allowed the material to remain nine months after implantation in the peritoneal cavity. At autopsy he noted encapsulation of the particles by a thin film of hyaline connective tissue, without formation of adhesions.

Methyl methacrylate has been used clinically to repair cranial defects and to study the brain and the pial circulation. It has been used successfully in reconstructive surgery as a substitute for cartilage, in the correction of facial deformities (Penhal Brown) and in arthroplasty for osteo-arthritis (Harmon). It was first used experimentally to secure a pulmonary collapse by Wilson and Baker in 1944. "The effects of this plastic material inserted into the pleural cavity of thirty rats and into the extrapleural space of ten dogs, was studied. A collapse of individual lobes was secured in approximately one-half of the rats by inserting into the pleural cavity a portion of the plastic, re-molded into the shape of the lobe to be collapsed. In the other one-half of the rats, the pleural cavity was filled with small ¼ inch balls. None of the animals showed any systemic reaction and tolerated the material well. X-rays taken at frequent intervals following the operation showed little evidence of pleural effusion. Autopsies performed at intervals of from 10 days to 8 months showed only slight inflammatory changes and no foreign body reaction. The balls were surrounded by a thin serum immediately following the operation, and the pleura showed minimal thickening and infiltration with eosinophilia. The balls became encapsulated by a thin layer of hyaline connective tissue in the majority of the animals. The adjacent lung showed little evidence of reaction or atelectasis as a result of compression."

In our series of cases we have found that methyl methacrylate, in addition to being nonirritating to the tissues, possesses certain definite advantages over other foreign materials that have been advocated for plombage. The material is light-weight, and a large quantity can be introduced without danger of penetrating the pleura or the thin-walled cavities. It is radiotranslucent and does not interfere with the interpretation of roentgenograms. Both of these factors are of great importance in thoracic surgery.

We have used molded methyl methacrylate hollow balls 1 inch (2.5 cm.) and 1½ inches (3.7 cm.) in diameter. With balls of this size it is easy to fill pockets of various sizes developed in the extrapleural procedure. We have used 50 balls in a single patient without ill effects. Others have reported the use of 60 balls with

no ill effects. One patient remarked that she felt for a few days as though she had had a little too much air at a pneumothorax refill. As the air around the balls is absorbed, serum accumulates around these spheres. This serum becomes organized into hyaline connective tissue, maintaining the lung permanently in a collapsed state.

TECHNIC

The operative procedure consists of an anterior or a posterior incision. The anterior incision follows the anterior axillary line below the superior border of the pectoral muscles downward, lateral to the breast for about six inches. The belly of the pectoralis major may be incised or retracted. The third rib is exposed, and a section of 2½ to 3 inches is removed after removal of the periosteum, with care not to lacerate the parietal pleura. The pleura is carefully dissected off the chest wall to the extent desired for the collapse. The methyl methacrylate spheres (balls) have been sterilized by soaking in zephiran chloride, 1:10,000 dilution, for twenty-four hours. The extrapleural space is dried and the spheres are inserted into it until it is filled. The balls should not be pressed into the space so that they are tight—enough room must be left so that they may move with the downward and upward motion of the lung. If the space is packed too snugly, the patient may complain of pain in the arm from pressure on portions of the brachial plexus. The intercostal muscles are sutured with interrupted sutures. The rest of the wound is closed without drainage.

The posterior approach is made by an incision paralleling the spine just medial to the border of the scapula. The rhomboid muscles are divided; the posterior portion of the third rib is isolated and stripped of its periosteum for about 2½ inches. The technic of separating the parietal pleura is the same as in the anterior approach, but we prefer the posterior incision because of the proximity of the mediastinum and the greater ease of dissecting the parietal pleura in this region. Closure of the wound is made without drainage.

We have used streptomycin (1 Gm.) and penicillin and sulfa crystals (5 Gm.) locally in the wounds in about one-half of our cases. The other patients have received streptomycin, 1 Gm. daily, and penicillin, 50,000 units every four hours intramuscularly, and we are unable to see any difference in the reactions of the patients to the two procedures.

This operation has a number of advantages. 1. Operation can be performed with local anesthesia. 2. There is little or no shock or blood loss, and transfusions are rarely required. 3. The involved area of lung can be selectively collapsed, so that the function of normal lung tissue is preserved. This makes possible the successful treatment of patients with bilateral apical cavities, low vital capacity, and the like. 4. There is no mediastinal shifting after operation. Expectoration of sputum is easy, and there is little danger of bronchogenic spread. 5. Postoperative management is relatively easy. 6. There is no chest deformity or scoliosis.

INDICATIONS

The indications for extrapleural plombage with methyl methacrylate are limited, since the use of this material in thoracic surgery is still in the experimental stage. The indications, however, are much broader than those established for extrapleural pneumothorax. All but 4 of the patients for whom this procedure was used have been under a strict sanatorium regimen, and pneumothorax has been attempted and found unsuccessful. Recent spread does not constitute the same contraindication to this operation as it does to thoracoplasty. Many patients not suitable for either thoracoplasty or resection can be successfully treated by this method.

Patients considered most suitable for the operation are:

1. Patients with bilateral cavities.
2. Patients with unilateral cavities and infiltration in the opposite lung.
3. Patients in whom the pulmonary tuberculosis is complicated by asthma, diabetes, heart disease or low vital capacity.
4. Patients of advanced age who, because of their general physical condition, are not candidates for major surgical procedures.
5. Patients in whom thoracoplasty has been performed without successful closure of the cavity. Extrapleural stripping of the apex of the collapsed lung and plombage offers these patients a single-stage procedure with local

anesthesia, with little or no shock and with a good chance of cavity closure.

6. Patients with a thoracoplasty on one side, in whom a cavity has developed in the opposite apex.

7. Patients with cavities in the basal portion of the lung. In these patients, extrapleural pneumolysis and plombage of the lower lobe permits a selective collapse and preserves the function of the uninvolved upper lobe.

COMMENT

Extrapleural pneumolysis is based on sound surgical principles. Adequate collapse of the lung can be secured by this method as by intrapleural pneumothorax or thoracoplasty. Entrance into the extrapleural space probably occurs during the course of most thoracoplasties and is attended by little, if any, increase in danger to the patient. Many present-day thoracic surgeons routinely combine extrapleural apicolysis with thoracoplasty.

COMPLICATIONS

Complications of extrapleural pneumolysis and plombage with methyl methacrylate may be divided into two groups; namely, those arising as a result of the operative procedure, and those attributed to the use of methyl methacrylate. The first group includes (1) accidental rupture into the lung or a thin-walled cavity; (2) hemorrhage into the extrapleural space; (3) formation of a bronchopleural fistula; (4) tuberculous or secondary infection in the extrapleural space; (5) cardiac failure due to diminution of the pulmonary circulatory bed; and (6) pressure necrosis of the viscera and the visceral pleura.

The second group includes (1) brachial neuritis, due to too great a number of balls in the space, and (2) wandering of a ball out of the space owing to a rent in the pleura.

At this writing we are reporting 18 cases. In 13 we performed an extrapleural pneumolysis of the apex of the lung, and in 5 cases we operated for revision of a thoracoplasty. Ten of the patients were women, and 8 were men. Thoracoplasty revisions were performed on 2 of the former and on 3 of the latter group. In the case of 1 man the operation was performed extrapleurally on the apex of the right lung. The balls were removed the second day after operation owing to torn pleura, severe emphysema and a bronchopleural cutaneous fistula, which is now healing as after a Monaldi procedure.

The ages of these patients varied from 28 to 60 years. All had had bilateral lesions at some time previously, or at present. In 1 case, a man was operated on for the second time six months after the first pneumolysis and 17 spheres were added after extending the dissection of the parietal pleura. He had reopened his previous cavity and, two months after the second operation, had a normal sputum; and in three months, a normal gastric wash. The average time required to convert the sputum to normal was three months. In 11 cases gastric lavage now gives normal results, and in the remaining 7 cases, 5 have been done within the past sixty days, and two show rare bacilli in the sputum, 3 as negative to smears of the sputum. In 2 cases the sputum is not yet normal but has been reduced in quantity by 75 percent and is clear most of the time. The sedimentation rates in these cases compare favorably with that observed for thoracoplasty, varying from 18 to 40 mm. per hour.

The number of spheres (balls) inserted depends upon the size of the chest cavity and the extent of the pneumolysis. In our series it varied from 9 to 50 balls. Thoracoplasty revisions required only a small number of balls —about 8 to 10 on the average.

All, but one of these procedures have been successful to the time of writing. One patient had brachial neuralgia, which disappeared in ninety days with no paralysis of the arm or hand. This individual was an emaciated woman who gained 30 pounds in four months after the operation.

REPORT OF CASES

Case 1—A woman aged 41 was first seen in 1943 during a second breakdown (she had had one four years earlier). She was hospitalized, and sandbags were put over the affected area. There was hemorrhage from the apex of the right lung, and after eighteen months of bed rest the patient made uneventful progress and the sputum became negative from seventy-two hour concentrations. After two gastric lavages had given normal results she was dismissed from the hospital and resumed her daily routine.

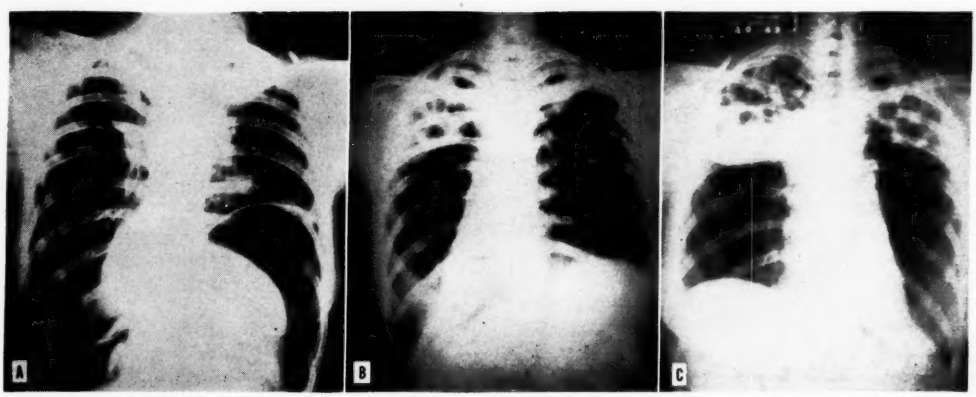

Fig. 1.—*A*, preoperative roentgenogram in Case 1. *B*, roentgenogram taken at first operation (Oct. 22, 1948). Fourteen balls of lucite (methyl methacrylate) were used. *C*, roentgenogram taken at second operation (March 28, 1949), at which 23 balls were used.

Records were kept of her progress until 1946 and then were discontinued until the summer of 1948. She was having a profuse hemorrhage from the left pulmonary apex. Some ten years ago, she had a permanent phrenic of the left side and noting the history of this phrenic, pneumoperitoneum was started immediately and the hemorrhage was controlled. About two weeks later there was hemorrhage from the right apex, but the attempt to control it was unsuccessful. A pneumothorax was instituted, which stopped the hemorrhage within a few hours, but it had to be discontinued after ten days because of severe dyspnea. After discontinuance of the pneumothorax the hemorrhage did not reappear, but direct smear tests of the sputum gave positive results and an area of infiltration combined exudative reaction and fibrosis with a 2 cm. cavity under the clavicle (Fig. 1A). Percussion over this area showed marked dullness as far as the second rib anteriorly and the fourth rib posteriorly. Moist crepitant rales were present constantly in this area.

Owing to the prolonged period of activity, an extrapleural pneumolysis was performed on Oct. 22, 1948 (Fig. 1B). Fourteen lucite balls were inserted into the extrapleural space at the time of operation. The patient's cough and sputum were reduced 50 percent. Ninety days after the operation, however, the sputum still gave markedly positive results for tubercle bacilli. Bronchoscopic examination revealed positive smears from the upper lobe of the right lung.

The second extrapleural pneumolysis was performed on March 28, 1949, and twenty-three lucite balls were inserted. There was little postoperative reaction and no dyspnea (Fig. 1C).

The patient had no cough and did not produce any sputum since the second week after the second operation and gastric lavage six weeks after operation, was negative to smears and culture.

The patient gained 10 pounds toward her average normal weight and at the time of writing is entirely symptom-free. However, it should not be understood that she is entirely normal, as repeat gastric lavages are still to be done.

Case 2—A woman aged 38 had an eight-year history of bilateral pulmonary tuberculosis with cavitation in the upper lobe of the right lung. A lesion on the left lung had been cleared by previous bed rest, but three cavities in the upper lobe of the right lung had not responded to eighteen months of pneumoperitoneum, which was employed after failure to produce a pneumothorax.

An extrapleural pneumolysis of the right upper pulmonary lobe was performed with removal of 3 inches of the third rib posteriorly. The pleura was dissected down to the fifth rib posteriorly and 13 lucite balls were inserted, after which the wound was closed.

The patient was symptom-free, with no cough and no sputum, one week after the operation. Gastric lavages at six weeks and four months gave negative results in smear, culture and guinea pig tests.

Case 3—A man aged 26 had moderately extensive bilateral tuberculosis with a large cavitation in the upper left pulmonary lobe and pathologic sputum. Bronchoscopic examination revealed moderate tracheal bronchitis, with practically all of the secretions from the left upper bronchus. Lesions throughout the upper and middle lobes of the right lung were of the fibrocaseous type, with very heavy

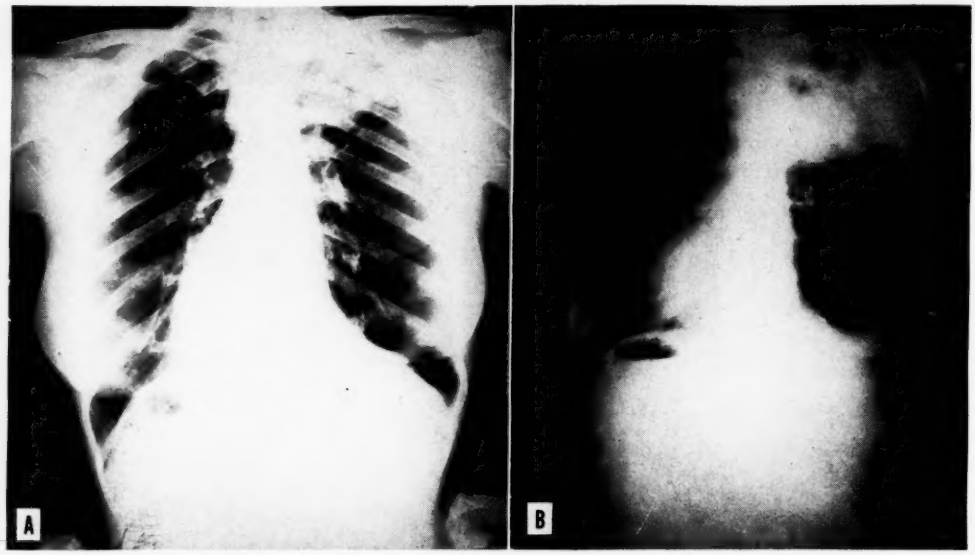

Fig. 2.—Preoperative (*A*) and postoperative (*B*) roentgenograms of patient in Case 2.

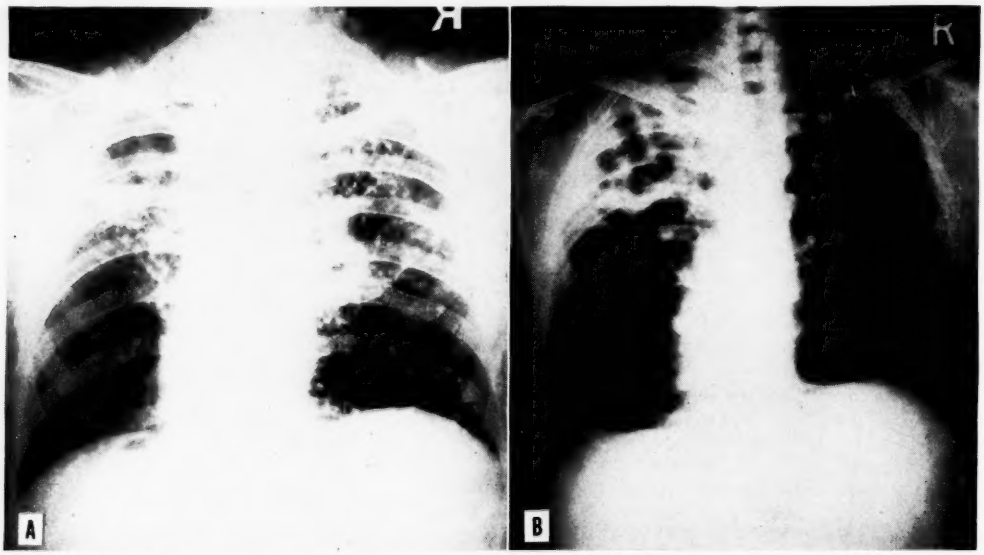

Fig. 3.—Preoperative (*A*) and postoperative (*B*) roentgenograms of patient in Case 3.

peribronchial markings. In spite of the large cavity in the upper lobe of the right lung, extrapleural pneumolysis was performed with removal of 3 inches of the third rib posteriorly. The pleura was dissected easily with a minimal amount of bleeding. Twenty lucite balls were inserted. The patient's productive cough subsided within two weeks. Direct smears of the concentrated sputum gave negative

results in six weeks, and gastric lavages taken at four and six months postoperatively gave normal results on smear, culture and guinea pig tests. A roentgenogram of the chest taken eight months after the operation revealed no spread of the disease in the left lung, and the perihilar region had returned to normal. The small scattered exudative areas throughout the right side of the chest had disappeared and showed only scattered scarring.

Due to the cavity's size in the left upper lobe, we felt that this was a border case to proceed on, but owing to the spread of the disease from this area, we felt that this procedure was less hazardous than thoracoplasty.

COMMENT ON CASES

These 3 cases are typical of the cases selected. At the time of writing, it has been necessary to remove the lucite balls in only 1 case in which removal took place forty-eight hours after the operation because of massive emphysema due to a tear in the pleura posterior near the mediastinum. However, this lesion of the chest wall has closed slowly and has kept about 80 per cent of the collapse produced at the initial operation.

SUMMARY

The use of methyl methacrylate plombage is still in the experimental stage, as it is only three and one-half years since the first work was done by Wilson and Block. However, the author's own patients have shown such favorable results as to warrant a continuance of the procedure. The cases must be selected carefully, and, if one of the less severe procedures can be instituted, it should be used in preference to methyl methacrylate plombage. Extrapleural pneumolysis with this plombage, in many selected cases, may be used instead of one-stage or two-stage thoracoplasty, to prevent the deformity that follows the latter operation; and it may be used to control cavities that have not closed after a previous thoracoplasty.

The procedure warrants further study, with variation in the size of lucite balls or a plastic material of some other shape, such as a bag or sponge, in an attempt to overcome the disadvantage of pressure necrosis. Some of this change in shape of material and its effect on experimental animals (e.g., sponge) has been reported, with favorable results, by Dr. John B. Grow, Director of Surgery at the National Jewish Hospital of Denver, Colorado.

Recent reports of many surgeons show that the complications formerly associated with paraffin plombage (especially secondary infections) are not as frequent as heretofore. Continued search in the field of plastics may result in a method devoid of the complications of necrosis and secondary infection. In view of the fairly high percentage of arrested pathologic processes noted in recent literature, and the few complications, the procedure must not be discarded.

RÉSUMÉ

L'emploi du plombage au méthyl méthacrylate est encore au stade expérimental et il y a seulement 3 ans et ½ qu'a paru le premier travail fait par Wilson et Block. Cependant, les propres malades de l'auteur avaient eu des résultats si favorables que cela justifia la continuation de l'emploi de ce procédé. Les cas doivent être soigneusement triés et si un procédé plus bénin peut être institué on doit se servir de préférence du plombage au méthyl méthacrylate. Dans beaucoup de cas on peut employer la pneumolyse extrapleurale avec ce plombage au lieu de la thoracoplastie en un ou deux temps pour éviter la déformation qui suit la dernière opération, et elle peut être employée pour obturer des cavités qui n'avaient pas été fermées aprés une thoracoplastie antérieure.

Le procédé nécessite d'autres investigations telle que la variation de dimension des balles transparentes ou de matériel plastique ayant une autre forme tel qu'un sac ou une éponge pour essayer d'éviter l'inconvénient de la nécrose par pression. Quelques un de ces changements dans la forme du matériel et ses effets expérimentaux sur les animaux (par ex. l'éponge) ont été décrits avec des résultats favorable par Dr. John B. Grow, Directeur de la Section Chirurgicale à l'Hôpital Juif Nationale de Denver, Colorado.

Les rapports récents de plusieurs chirurgiens montrent que les complications qui auparavant suivaient le plombage de paraffine (particulièrement les infections secondaires) ne sont pas aussi fréquentes qu'auparavant.

Les recherches continues sur les plastiques pourront avoir comme résultat la mise au point d'une méthode à l'abri des complications de nécrose et d'infection sécondaire. Si l'on considère le pourcentage, relativement élevé, des processus pathologiques arrêtés dans leur évolution, que l'on rencontre dans les publications récentes, et leur peu de complications, on doit continuer à employer ces procédés.

SUMARIO

El uso del plombage de metacrilato de metilo està aun en la etapa experimental, pues solamente han pasado 3 años y medio desde su introducción por Wilson y Block. Sin embargo, lòs resultados obtenidos por el autor de este papel han sido tàn favorables, que en sù opinión este método de tratamiento merece su continuación. Los casos deben de ser seleccionados con cuidado y su uso no debe de suplantar los métodos menos radicales. Este metodo de plombage en combinación con la neumolisis extra-pleural, en casos seleccionados, se podría usar en preferència á la toracoplastía, cuando se quiren prevenir las deformidades que subsiguen al último procedimiento y también se podría usar para controlàr las cavidades que no han respondìdo á la toracoplastía.

Este procedimiento de plombage merece más estudio en relación con el tamaño de las bolas de lucite o de otro material plástico de otra forma, tal como bolsas oc sponjas, con el objeto de eliminar lo más posible las necrosis por presión. Dr. John E. Grev, Director de Cirugía del Hospital Nacional Judío de Denver Colorado, ha reportado buenos resultados en sus animales experimentales, cambiando la forma del material (ej. esponja).

Los reportes recientes de muchos cirujanos revelan que las complicaciones que anteriormente se presentaban con el plombage de parafina (especialmente la infección secundaria) no son tan frecuentes. La investigación en el campo de materiales plásticos pueda que con el tiempo produzca un método que esté libre de las complicaciones de necrosis y de infecciones secundarias. En vista del porcentaje elevado de los casos patológicos que han sido arrestados por este tratamiento, segun la literatura, y de las pocas complicaciónes que se han notado en estos casos, este procedimiento no debe de descartarse.

RIASSUNTO

L'uso di metil metacrilato per ricolmare cavita' polmonari e' tuttora nella fase sperimentale: non sono passati che 3 anni dal primo lavoro di Wilson e Block. I risultati conseguiti dall'A. sono pero' cosi' buoni, da giustificare una piu' larga adozione di questo nuovo materiale. I casi clinici vanno selezionati accuratamente e se una tecnica operativa piu' semplice puo' essere adottata, e' preferibile sostituirla a quella che richiede l'uso di metacrilato. Una pneumolisi con questo materiale puo' essere eseguita invece della toracoplastica in una o due tappe, onde prevenire la deformita' che conseguono a quest'ultima operazione, oppure per richiudere delle cavita' che non si sono cicatrizzate dopo una precedente toracoplastica. Per ovviare agli svantaggi della necrosi da compressione, bisogna variare il volume della palla di lucite o di altri materiali plastici, tenendo anche conto della forma di questo materiale (spugne, sacchetti, ecc.). Gli effetti di queste variazioni sopra gli animali da esperimento sono stati illustrati recentemente da Grow, Direttore del reparto Chirurgico dell'Ospedale Nazionale Ebraico di Denver, Co. L'uso della paraffina quale materiale da riempimento appare meno temibile, specie in rapporto al pericolo di infezioni secondarie, di quanto sembrasse nel passato.

Ulteriori indagini nel campo delle materie plastiche offriranno probabilmente al chirurgo il mezzo per evitare sia infezioni, sia necrosi. I risultati conseguiti in questi ultimi tempi dimostrano un'alta percentuale di arresto del processo infiammatorio: occorre quindi perseverare in questo nuovo indirizzo terapeutico.

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Experimental Studies on Vascularization of Bony Calluses

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IT IS well known that the most important histologic elements in the formation of bony callus are osteoblasts and vascular proliferation; the interstitial connective tissue participates but little. In the past numerous experimental studies have been carried out to ascertain the origin of the osteoblasts in the bony callus, but now it can be said with certitude that they arise from well defined cellular elements that do not share in the primitive ossification process, remaining in the bone in an indifferent state but still retaining the capacity for regeneration as bone tissue if circumstances warrant.

Further, it is known that osteoblasts, which can be found in any bone, are particularly plentiful directly under the periosteum, where they lay down a distinct stratum adherent to the internal surface. During the proliferative process at the site of the bony callus, the osteoblasts follow the newly formed vessels and distribute themselves about them. It follows, therefore, that vascularization phenomena are of the utmost importance in the evolution of callus. This has been studied in the physiology laboratory by means of ordinary methods of staining that reveal the endothelium of the blood vessels, but these researches are insufficient, because they do not permit direct vision of the origin and distribution of the vascular granulation tissue, and they have been subject to false interpretation.

It was therefore my desire to take up the experimental study of this problem by a new method which I suggested to the histologist, G. Rosso, which enabled me to delineate the presence of vessels in the bone and in the callus. This method represents a marked improvement over the old method of Krogh, which consists of the intravenous injection of india ink, diluted in Ringer's solution, into live animals; but the vessels are not always well revealed by this technic, because of histologic technicalities, and yield only an imperfect reproduction of the vascular pattern. The new method consists of treating the bone, after decalcification, with a concentrated formic acid solution, which, without altering the aspect of the vascular net of the bone after the injection of india ink, transforms the bone substance into such a transparency that micrometric sections become useless. Thirty-five cc. of a solution consisting of 80 parts india ink to 20 parts Ringer's solution is injected into the abdominal aorta of a live rabbit. This permits the vascular bed of the hindlimbs to become filled with the ink. The rabbit is killed after the injection. The limb, with its soft tissues, is fixed in solution of formaldehyde for four hours, washed rapidly in distilled water, and decalcified for ten hours in 10 per cent aqueous solution of concentrated nitric acid. The decalcified piece of bone is then sectioned in two equal parts along its long axis so as to obtain a rectangular section from the tubular bone, which is again washed in distilled water and immersed in a concentrated solution of formic acid for two hours. After repeated washings in absolute alcohol and xylol the slides are mounted in Canada balsam.

Examination of the normal bone slides enables one to observe clearly all the details of the vascular pattern, which is very rich. The vessels are essentially rectilinear and parallel to the long axis of the bone. An impressive number of anastomoses unite the vessels in all directions, regardless of caliber, thus aiding materially to increase the vascularity of the network.

In a series of 21 rabbits with artificially produced fractures of the middle third of the shaft of the femur, sections were taken by the aforedescribed technic after five, ten, twenty, thirty, forty, seventy and one hundred and forty days. The surrounding soft tissues were studied with the callus, and the entire formative process

From the University of Turin Medical School, Department of General Surgery.

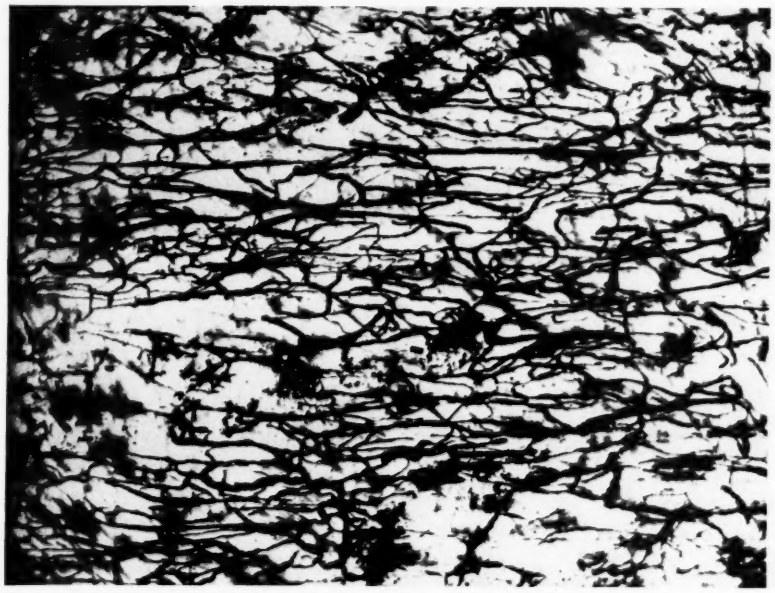

Fig. 1. Vascular network of normal bone. Observe the predominantly rectilinear course parallel to the axis of the bone. Note also the extraordinary abundance of anastomoses. The vessels are of variable caliber.

Fig. 2. Evolution of vascularization of bone callus. Note penetration of large vessels from the connective tissue surrounding the fracture site and branching into the bone callus, forming a delicate network of vessels of varying caliber. Although this photomicrograph was taken after only ten days (see text) numerous anastomoses are already present.

Fig. 3. Evolution of vascularization of bone callus, ten days after experimental fracture. Note the richness of vessels coming from the stumps that penetrate into the callus, branching out therein with a predominantly rectilinear course and forming anastomoses with vessels coming from the surrounding connective tissue to the fracture site.

of vascularization in bone callus was clearly revealed. During the first few days many new blood vessels were observed, running a twisted and irregular course at the site of the fracture (Fig. 2). The caliber of these vessels was variable, but they were always smaller than those observed at the site of the old callus. Most of these vessels came from the bone fragments adjacent to the fracture site, and there was evident continuity between the vessels of the normal bone and the newly formed vessels of the callus (Fig. 3). Other vessels, of larger caliber, arose from adjacent connective tissues, penetrated the callus perpendicular to the bony axis and then split into little branches, which also formed vascular loops. In this respect the vascularity of callus is quantitatively greater than that of normal bone.

After twenty days it was noted that the vascularity of the callus had undergone even further quantitative increase from the proliferation of vessels arising both from the bone and from adjacent connective tissue. But the vascular architecture during this period was completely different from that of normal bone. The blood vessels were twisted, and there was no trace of the parallel design observed in normal bone.

After thirty days the fracture site was crossed by large vessels from which vessels of smaller caliber arose and which took a course parallel to the diameter of the bone, though not yet rectilinear.

After the fortieth and seventieth days the vascular pattern closely approximated the normal. The vessels were of almost uniform caliber, followed a rectilinear course parallel to the bone axis, and are continuous with the vessels of the adjacent bony fragments. There were numerous anastomoses with the vessels arising from the surrounding soft tissues, and still more anastomoses between the individual vessels, which approximated the vascular pattern of normal bone (Fig. 4).

After one hundred and forty days the arrangement of the vascular network in the callus reproduced the normal structure. The vessels were rectilinear, and the frequency of

Fig. 4. Evolution of vascularization of bone callus forty days after experimental fracture. The bone callus is now abundantly vascularized. The vessels are of large caliber and form a rich network of anastomoses. They take a somewhat irregular course but show a tendency to run parallel to the bone axis.

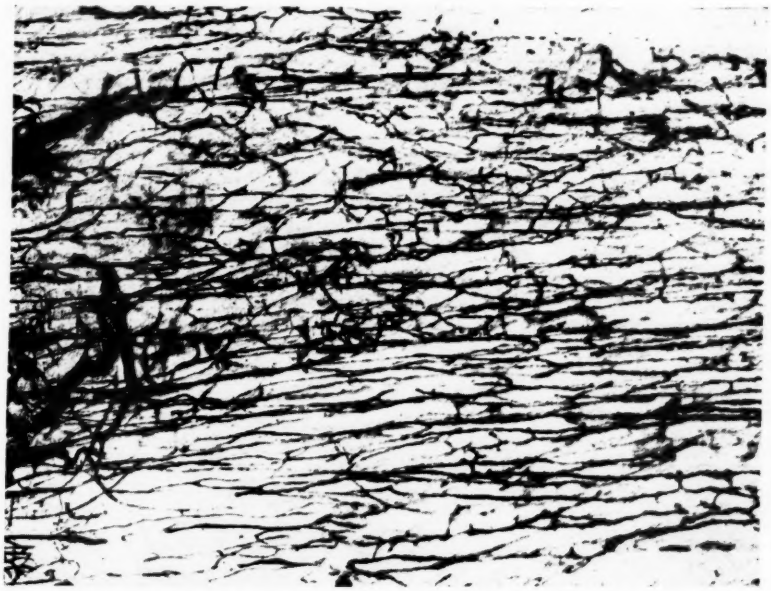

Fig. 5. Vascularization of bone callus one hundred and forty days after experimental fracture. The vascular network is quantitatively decreased; the most important trunks run longitudinally parallel to the bone axis. The final vascular network is analogous to that of normal bone.

anastomoses was similar to that seen in normal bone. This vascular pattern was predominantly continuous with the vessels of the bone fragments, but anastomoses could still be observed between these vessels and those arising from the nearby connective tissues, with a tendency toward decrease in caliber and frequency (Fig. 5).

SUMMARY

1. A few days after a fracture, the hematoma in the fracture site is rapidly replaced with vessel buds and newly formed vessels, which run a twisted course and are more numerous than the vessels seen in normal bone.

2. The newly formed vessels of the callus (in opposition to the opinion of Lubarsch and Lauche, who have stated that the vessels of the callus take origin exclusively from the adjacent connective tissue), originate equally from the vascular pattern of the bony stumps and from the pericallous soft tissue. This fact is of considerable importance because, as has been said, the osteoblasts follow the proliferating vascular buds. If, however, there is injury of the bone ends, the development of these vessels and the formation of the callus are delayed.

3. During the evolution of the callus the newly formed vessels gradually follow a longitudinal route parallel to the bone axis. With the appearance of numerous anastomoses between various vessel trunks in the callus site, normal vascularization of bone is completely reproduced.

RÉSUMÉ

1. Peu de jours après une fracture, l'endroit où se produit l'hématome dans la fracture est rapidement comblé par des bourgeons vasculaires et des vaisseaux de néo-formation qui s'accroissent dans un parcours tourmenté et sont plus nombreux que les vaisseaux recontrés dans un os normal.

2. Les vaisseaux de néo-formation du cal (à l'encontre de l'opinion de Lubarsch et Lauche, qui ont établi que les vaisseaux du cal prennent leur origine exclusivement dans le tissu conjonctif adjacent), proviennent également du lacis vasculaire des moignons et des tissus mous entourant le cal. Ce fait est d'une importance considérable parce que, comme on l'a dit, les ostéoblastes suivent la prolifération des bourgeons vasculaires. Si, cependant, les extrémités de l'os sont traumatisées, le développement de ces vaisseaux et la formation du cal sont retardés.

3. Pendant l'évolution du cal les vaisseaux de néo-formation suivent progressivement une route longitudinale parallèle à l'axe de l'os. Montrant de nombreuses anastomoses entre les différents troncs vasculaires à l'endroit du cal, la vascularisation normale de l'os est complètement rétablie.

RIASSUNTO

1. Nei primi giorni dopo una frattura, l'ematoma fromatosi nella sede stessa della frattura viene rapidamente sostituito da gemme vascolari e da vasi neoformati, aventi un decorso tortuoso ed in numero assai maggiore che nell'osso normale.

2. I vasi neoformati nel callo derivano (a differenza di quanto hanno ammesso Lubarsch e Lauche, secondo i quali questi avrebbero esclusivamente origine dal connettivo limitrofo) in parte dal sistema vascolare dei monconi ossei, in parte dal tessuto molle pericalloso. Questo fatto assume una notevole importanza, in quanto gli osteoblasti seguono i gettoni vascolari in via di proliferazione. Ne consegue, che se la lesione interessa i monconi ossei, la proliferazione di questi vasi e—per riflesso—la formazione del callo viene ritardata.

3. Durante lo sviluppo del callo i vasi neoformati seguono gradatamente un decorso longitudinale, parallelo all'asse dell'osso. Con la comparsa di numerose anastomosi fra i tronchi vascolari nella zona del callo, una normale vascolarizzazione dell'osso viene rapidamente riprodotta.

SUMARIO

1. Pocos días después de una fractura osea el hematoma que se ha formado es invadido rápidamente por nuevos vasos sanguíneos. Estos vasos son tortuosos y más numerosos que en el hueso normal.

2. Las neo-formaciones vasculares del callo, en la opinión del autor, se originan igualmente de los troncos vasculares hueso en la región misma de la fractura y de los tejidos blandos que envuelven al callo. (Esta opinión es por

lo tanto, contraria a la de Lubarsch y Leuche, que han declarado que los vasos sanguíneos del callo se originan exclusivamente de los tejidos adyacentes al callo.

Este hecho es de importancia, por cuanto, como ya se ha dicho, los osteoblastos siguen a las proliferaciones neo-vasculares. Esta es la razón por qué el traumatismo de las extremidades del hueso se acompaña por retardo en la formación del callo.

3. Durante la formación del callo, las neoformaciones vasculares siguen una ruta paralela al eje (axis) mayor del hueso. La aparición de numerosas anastomosis entre los troncos vasculares de la región del callo, completan y reproducen la vascularización normal del hueso.

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The publication date of the

New Roster

of the International College of Surgeons

is approaching. Those who have not sent in their new addresses or proper teaching affiliations will please do so immediately. All members of the United States Chapter should send these data to 1516 Lake Shore Drive, Chicago 10. Ill. International members should write to the Secretary General. Dr. Max Thorek. 850 West Irving Park, Chicago 13. Ill., U.S.A.

Solitary Diverticulitis of the Cecum: A Simple Method of Management

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LAWRENCE G. KHEDROO, M.D.
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ALTHOUGH diverticula may occur anywhere along the gastrointestinal tract, from the pharyngo-esophageal junction to and including the rectum, solitary diverticulum of the cecum is rare. Such an outpouching is more frequently observed in the colon, particularly the sigmoidal portion.

In 1898, Graser first described sigmoidal diverticulitis as a form of tumor (tumor of Graser). In 1911, Chutro[1] reported a case of what he described as an anomalous appendix; however, Potier,[2] in 1912, is credited with the first report of diverticulitis of the cecum. Various isolated cases have been reported since the initial recognition of this entity. In 1940, Schnug[3] reviewed the literature, collecting 32 cases and adding his own. In 1943, Baker and Carlille[4] reviewed the English and American literature of the preceding twenty years, encountering 37 cases and adding 2 of their own. In 1945, Dussaut and Sanroma[5] related their experience in 2 cases. During the following year, Vernengo and Villafane[6] added another case. It is possible that numerous additional cases have been observed but not reported.

The predominance of diverticulitis of the cecum in the male over its incidence in the female is 2 to 1. Ochsner and Bargen[7] have estimated this predominance as 2.75 to 1 among patients in whom diverticulitis was present at the time of examination. As to the age incidence, the condition occurs usually in persons past 35, the majority being close to the fifth decade of life.

Since this condition was first described, several theories have been advanced as to its cause. Glandular or neuromuscular dysfunction, muscle weakness, increased intracolonic pressure, a potential weak spot in the intestines at the site of entrance of blood vessels, vascular stasis and the degenerative changes of senility have been held responsible. Recently, Dixon[8] has suggested the following plausible sequence of events producing diverticulitis: "First, diverticula are probably formed by contraction occurring simultaneously distal and proximal to a normal segment of bowel. The increased tension created in the normal segment by the above mechanism causes herniation of small portions of the mucosa through the wall of the bowel at areas of least resistance." However, none of these theories explains conclusively the production of diverticulosis.

Telling,[9] in 1908, classified diverticula as congenital and acquired. The congenital or true diverticulum occurs when all coats of the intestine are present; the acquired or false diverticulum, when the muscular coat is absent or very thin at a point where it is difficult to differentiate between the circular and the longitudinal fibers.

According to Schnug, the sites of cecal diverticulitis in order of frequency are as follows: (1) externolateral, (2) anterior and (3) on the ileocecal curvature. The diverticulum varies in length and not infrequently terminates in a bulbous expansion. In the case observed by Chutro it measured 14 cm. Sometimes, instead of an enlargement, the diverticulum terminates in a fibrous cord.

There are no clinical points of difference between diverticulitis of the cecum and acute appendicitis. There is pain in the right iliac fossa or over the McBurney region; the patient has a moderate fever and leukocytosis. Physical examination reveals localized deep tenderness in the right iliac fossa over McBurney's area. In many cases a tender mass is palpable. This mass may be mobile or somewhat fixed.

Preoperatively this condition is indistinguishable from acute appendicitis. A barium enema is contraindicated because of pain

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in the cecal region, although Boekus[10] has stated that roentgen examination rarely aids in diagnosis.

After the abdomen is opened, the hard inflammatory mass felt at the cecum suggests the following possibilities in order of frequency: malignant tumor, hyperplastic tuberculosis, actinomycosis, nonspecific ulceration of the cecum and regional ileitis. This localized inflammation of the cecum arising from the diverticulum on its wall may have caused perforation due to local abscess formation; or, occasionally, generalized peritonitis is present. The appendix is usually not involved.

REPORT OF CASE

Mrs. M. M., a well developed, well nourished white housewife aged 55 and weighing 160 pounds (73 Kg.) was admitted to St. Elizabeth's Hospital on Jan. 15, 1949, with the initial complaints of two episodes of vomiting and generalized abdominal pain which had lateralized to the right lower quadrant within the last twelve hours. An inventory of symptoms by systems revealed no other gastrointestinal subjective complaints and no complaints referable to the other major body systems. The history revealed no previous operations, injuries or illnesses. The family history and the gynecologic history were noncontributory.

The patient was cooperative but stoical. She was not in acute distress. Her oral temperature on admission was 100 F., and her respiration rate was 24 per minute. The color and texture of the skin were normal. Examination of the head, eyes, ears and nose disclosed no abnormality except moderate conduction deafness in the right ear. Examination of the mouth revealed edentulous jaws; the oral and pharyngeal mucosa was normal. The lungs were clear to percussion and auscultation. Examination of the heart disclosed a rate of 74, regular rhythm, and no murmurs; cardiac percussion revealed the apex beat 11 cm. to the left of the midsternal line in the fifth intercostal space. The blood pressure was 146 mm. of mercury systolic and 78 diastolic. Abdominal examination disclosed moderate obesity, no scars, no vessels on inspection; palpation revealed tenderness and rigidity in the right lower quadrant, with rebound tenderness; a palpable mass about the size of a golf ball was felt in the right lower quadrant; auscultation disclosed continuous bowel sounds. Examination of the lymphatic system gave negative results. The neurologic deep reflexes were normal. Rectal examination disclosed tenderness on pressure toward the right iliac fossa.

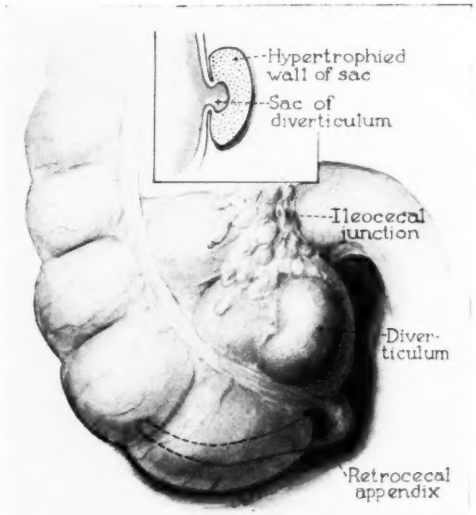

Fig. 1.—Solitary diverticulitis of the cecum.

Laboratory examination revealed an erythrocyte count of 5,500,000; the leukocytes numbered 14,000 with 75 per cent polymorphonuclears. The value for hemoglobin was 14.5 Gm. per hundred cubic centimeters of blood. Urinalysis for albumin, sugar, acetone and cells gave negative results.

The preoperative impression was that of an acute abdominal condition (acute appendicitis) or a twisted ovarian cyst. After suitable preparation the patient was laparotomized. The cecum was mobilized, and a mass about the size of that palpated extra-abdominally was noted on the anterior cecal wall, below the ileocecal junction. The mass was indurated to palpation, disclosed a broad base of attachment and showed signs of acute inflammation. The ileum showed no pathologic change. The appendix was not inflamed but was bound down retrocecally to the posterolateral abdominal wall. There were soft palpable glands at the root of the mesentery. The stomach and biliary region, as well as the pelvic organs, rectum and colon were normal to palpation. We decided to exteriorize the cecum to study the tumor further. In the process, to enable us to deliver the cecum properly, we performed an appendectomy. The exteriorization was modified after a method described by Frehling.[11] The peritoneum was closed with No. 0 plain catgut suture up to and surrounding the tumor mass. The fascia was likewise approximated with No. 0 chromic catgut suture.

Fig. 2.—Photomicrograph showing (from top down) mucosa, lymph node, mucosa muscularis, submucosa and serosa. The lymph node shows moderate hyperplasia. Disarrangement in the mucosa muscularis is due to inflammatory exudate. In the submucosa, note the disarranged muscle fibers, oblique, circular and longitudinal, the result of irregular development and inflammatory exudate. (Irregular development of the musculature may be ascribed to the fact that peristalsis in the diverticulum is minimal as compared with similar physiologic function elsewhere in the large bowel.) The serosa exhibits swelling, again due to inflammatory exudate.

The skin and subcutaneous fatty tissue were approximated with interrupted silkworm sutures above and below the intervening mass. A vaseline gauze dressing was applied over the exteriorized mass, which now protruded through the skin. The patient returned from the operating room in good condition.

On January 17, forty-eight hours after the operation, the exteriorized mass was resected. With removal of the mass the remainder of the bowel was permitted to retract into the abdomen. The surrounding peritoneum had sealed the base where the mass originally existed, and the cutaneous defect was closed with interrupted dermal sutures. On January 24 the area of the wound showed good healing except for a small fistulous opening.

The postoperative course was uneventful except for a pulse rate of 100 on the second and third postoperative days. The patient was discharged from the hospital on the twelfth day, ambulatory and in good general condition.

The biopsy specimen was described by Dr. Jerry J. Kearns as follows: "The tumor consists of a discoid, semifirm mass measuring 3 cm. x 0.5—1 cm. It varies from grayish tan to mottled dusky red and is moist. At about the midpoint of the tumor on the long axis, there is a soft, dark gray to white area 0.4 by 0.3 cm., which is present on only one surface. Microscopic examination reveals that the tumor mass consists of large bowel, which at one point is replaced by amorphous granular debris consisting of red cells, acute inflammatory cells, edema and bowel wall. Elsewhere the mucosa, membrana propria, mucosa muscularis, submucosa, and intermuscular tissue and serosa are edematous and infiltrated with acute inflammatory cells and eosinophilic leukocytes. Muscle fibers, circular and longitudinal, are markedly attenuated and disarranged.[11]

The microscopic diagnosis was solitary cecal diverticulum with acute and necrotic inflammatory changes.

COMMENT

We report this case of solitary diverticulitis of the cecum because of its rarity, because its manifestations were indistinguishable from those of acute appendicitis, and because of a modified method of treatment first described by Frehling.

A review of the literature, shows that the type of operation performed for diverticulum has varied according to the extent of the lesion. Some surgeons have elected to do simple resection of the diverticulum; others have chosen a more extensive procedure, such as resection of the cecum and hemicolectomy. The latter was done when the pericecal mass or induration was so great that the condition was mistaken for carcinoma or tuberculosis of the cecum.

With the diagnosis established, several types of operative procedure are advocated. These depend upon the location of the diverticulum on the cecum in respect to the ileocecal valve. If the diverticulum is on the lateral or the anterior portion of the cecum, a simple resection of the diverticulum is performed, almost in the same manner as resection of an acutely inflamed and suppurating appendix. If the diverticulum is situated close to the ileocecal valve, a more radical procedure, such as the Lahey-Mikulicz type of exteriorization, has been advocated. However, in some cases the cecum and part of the ascending colon have been resected, intestinal continuity being reestablished by means of a side-to-side ileocolostomy.

It is in such cases as this, in which the diverticulum is close to the ileocecal valve, that our modification of Frehling's procedure is indicated. Here the exteriorization is performed by using the cecum with its pericecal mass. The peritoneum and fascia are closed above and below the exteriorized bowel; the skin is left open at the center of the wound. After forty-eight hours, with the peritoneum sealed around the base of the mass, the diverticulum is excised and the edges of the skin are approximated with interrupted dermal sutures. This obviates a major resection, and the resulting fistula usually closes within a few weeks. However, if the diverticulum has perforated or is undergoing abscess formation, this procedure cannot be followed.

SUMMARY

1. Solitary diverticulitis of the cecum is rare.

2. This condition simulates acute appendicitis or cecal tumor.

3. Treatment is always surgical, extirpation of the diverticulum being the method of choice.

4. A modified surgical procedure after Frehling (exteriorization of the cecum with its pericecal mass) is recommended as a simpler method, especially for surgeons in

whose practice this particular lesion has been encountered rarely, if ever.

SUMARIO

1. La diverticulitis solitaria del intestino ciego es rara.

2. Cuando se presenta simula la apendicitis aguda o un tumor cecal.

3. El tratamiento es siempre quirúrgico. La extirpación del divertículo es el método de selección.

4. Se recomienda en ciertos casos la modificación del procedimiento quirúrgico de Frehling, que consiste en la exteriorización del intestino ciego, especialmente cuando el cirujano no está familiarizado con esta condición patológica.

RÉSUMÉ

1. La diverticulite isolée du coecum est rare.

2. Des tels cas peuvent faire croire à une crise d'appendicite aigue ou à une tumeur du coecum.

3. Le traitement est toujours chirurgical, l'ablation du diverticule restant la méthode de choix.

4. Un procédé chirurgical modifié du à Frehling (l'extériorization du coecum et de masse péricoecale) est recommandé comme étant une méthode plus simple, particulièrement pour les chirurgiens qui ont eu rarement l'occasion de rencontrer ce genre de cas dans leur pratique, si jamais ils l'ont eu.

RIASSUNTO

1—La diverticolite solitaria del cieco e' rara.

2—Quest'affezione ricopia la sintomatologia dell'appendicite acuta o di un tumore del cieco.

3—La cura e' sempre chirurgica: l'asportazione del diverticolo e' il metodo di elezione.

4—L'esteriorizzazione del cieco con la massa pericecale (metodo proposto da Frehling) puo' essere talvolta raccomandato, per la maggiore semplicita', quando la diverticolite si presenti a chirurghi non aventi precedente esperienza in materia.

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Adenocarcinoma and Carcinoid of the Appendix

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THE value of examining microscopically all tissue surgically removed, whether it is a hemorrhoidal tag or an innocent-looking appendix, was again called to our attention when a pathologic report of a surgically removed appendix came back with a microscopic diagnosis of adenocarcinoma. This interesting but surprising condition is so rare that it is not impossible for an actively practicing surgeon to go through his entire surgical career without encountering it, to say nothing of diagnosing it preoperatively. In reporting this case, we think it worth while to present and discuss adenocarcinoma in relation to a case of carcinoid of the appendix also observed in this clinic.

In reviewing the medical literature, one finds some confusion with regard to these two conditions. Many authors have grouped adenocarcinoma and carcinoid together as malignant growths. By most writers Beger is given credit for reporting the first unquestionable case of primary carcinoma of the appendix, in 1882. Twenty-one years later Moschkowitz,[1] in a careful search of the literature, found only 18 cases of carcinoma of the appendix. From then on it was assumed that, since the appendix was being subjected more and more often to microscopic examination, the resultant increase in the incidence of carcinoma was to be expected. In 1926, Van Alstine[2] reported 2 cases and on reviewing the literature found an additional 300. Three years later Salinger reported 34 cases of primary carcinoma of the appendix collected from the Post Graduate Hospital in New York. More recently, Young and Wyman[3], surveying the literature from 1932 to 1942, found many cases of carcinoma of the appendix. On careful scrutiny, however, they noted that many authors had grouped carcinoids and adenocarcinomas together without making any distinction between them. Consequently, they were able to accept only 4 cases reported in the ten-year period as cases of true adenocarcinoma. The reason for this apparent confusion is the fact that in the earlier literature all carcinoids were described as malignant growths. Ellwood[4] credits Lubarsch with first describing carcinoid as an interesting but separate pathologic entity in 1888. It was not until 1907, however, that Oberndorfer of Germany discussed this tumor in detail, pointed out facts differentiating it from true carcinoma, and coined the name carcinoid. He went on to say that carcinoids never metastasize and that recurrences after operation, which seldom take place, are only local. Strange to say, the same tumor, if it arises from the stomach or large bowel, will metastasize. Ewing[5] also, in his *Textbook of Pathology*, stated that carcinoid tumors are practically always benign. Foot,[6] in his *Textbook of Pathology in Surgery*, stated that carcinoids arising in the appendix are almost invariably noncancerous. Furthermore, these benign tumors have often been found at routine autopsy in the appendixes of patients who died of some unrelated condition. It thus becomes obvious that adenocarcinomas and carcinoids must be properly recognized and differentiated if proper surgical treatment is to be instituted.

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ETIOLOGY

The cause of both adenocarcinomas and carcinoids is unknown. The appendix, being a vestigial organ, frequently infected and with a poor blood supply, provides ample ground for discussion. Masson,[7] however, stated his theory of the origin of carcinoids by saying: "Carcinoids result from proliferation of intranervous argentaffin cells of neurocrine type."

INCIDENCE

The true incidence of adenocarcinoma of the appendix, when the various reports are scrutinized, is exceedingly low. The case here described is the first to be encountered in this clinic since its organization in 1911, whereas carcinoids have been frequently seen. Selinger[8] found 34 cancerous lesions of the appendix

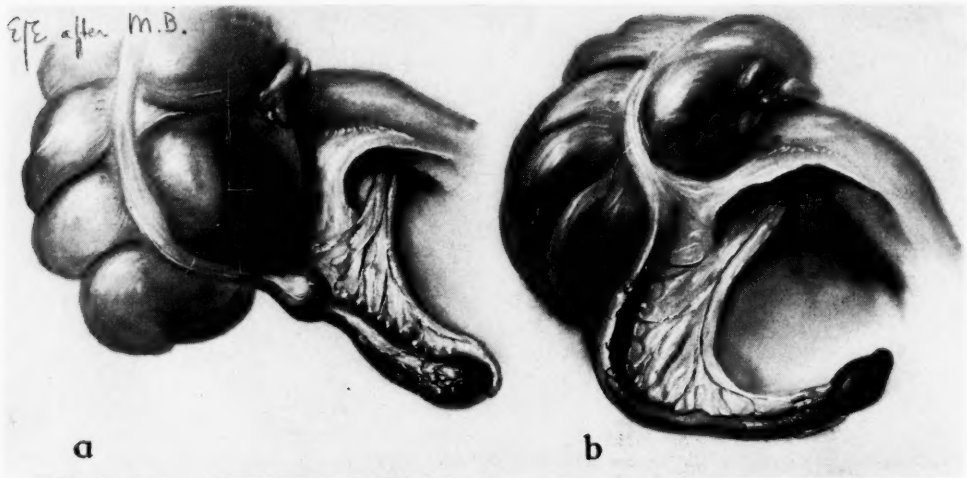

Fig. 1. Comparison of (*a*) gross appearance and location of adenocarcinoma at base of appendix as seen in the operating room in Case 1 with (*b*) gross appearance and typical location of carcinoid at tip of appendix as observed at operation in Case 2.

among 45,302 pathologic specimens of all types. This constitutes 0.075 per cent of all the surgical specimens, or 0.35 per cent of all the appendixes removed. The extensive monograph of Simon[9] on appendiceal carcinoma and carcinoid shows already clearer distinction between these two forms of disease. Out of 325 appendiceal tumors mentioned, he considered 260 cases as carcinoids. In general, carcinoids are at least ten times more common than adenocarcinomas of the appendix. In turn, according to Jones,[10] carcinoids are five times more common in the appendix than in the small bowel. Bieren[11] reported 242 cases of adenocarcinoma of the large bowel to 2 cases of adenocarcinoma of the appendix between the years 1922 and 1939. Of the 2 patients with adenocarcinoma, 1 died of peritonitis in three days; the other survived operation to die in two years of generalized metastases. Schuldt[12] reported a total of 3,692 appendixes removed and studied at St. Joseph's Hospital in Minnesota. He reported that adenocarcinoma of the appendix had an incidence of 0.027 per cent as compared to an incidence of 0.216 per cent for carcinoid of the appendix. Thus, in general, adenocarcinomas are seldom seen and carcinoids are more frequently encountered.

AGE AND SEX

Like malignant growths elsewhere in the gastrointestinal tract, adenocarcinomas occur most commonly in persons of advanced age, whereas the relatively benign carcinoid occurs mainly in the second or third decade of life. However, both types of growth have been seen in persons ranging in age from 5 to 80. Jones[10] found carcinoids most frequently among adults under 35. Porter and Whelan likewise observed that carcinoids of the appendix are encountered most frequently among persons in the third decade, and seldom in persons beyond it.

With regard to sex, it is common knowledge that both lesions occur more commonly in the female than in the male. Boyer,[13] in his report of primary carcinoma of the appendix, found 60 to 70 per cent occurring in females. Selinger[8] reported that, in 34 cases of primary carcinoma of the appendix, 28 or 82.4 per cent of the patients were female. Concerning this marked discrepancy he observed: "The female abdomen is subject to more surgery than the male abdomen, which in turn accounts for more routine appendectomies. With a larger number of female appendices to examine, it is logical that the greater number of carci-

nomas should be reported as occurring in that sex." This, too, may explain other authors' reports of carcinoids as occurring more frequently in the appendix.

LOCATION; GROSS AND MICROSCOPIC FEATURES

The gross appearance of the tumor and its location in the appendix is an aid in differentiating between adenocarcinoma and carcinoid. Montgomery and Johnson[14] stated that adenocarcinoma of the appendix is always situated in the proximal half of the organ (Fig. 1a). In contrast, 75 per cent of carcinoids occur in the distal fourth or in the tip of the appendix (Fig. 1b). Forty-six of 50 carcinoid tumors reviewed by Masson were situated at the distal end of the appendix. No explanation has ever been given for this rather consistent finding. Perhaps more argentaffin cells are present at the tip of the appendix.

Uihlein and McDonald,[15] in a recent article, remarked: "On gross examination the lesions may be either polypoid or ulcerative, just as are carcinomas of the large bowel. Because of their frequent location in the base of the appendix, obstruction to the appendiceal lumen usually results early in the course of the disease. As a consequence, acute appendicitis —usually with perforation—is a common occurrence. This results in early operative intervention, with removal of the diseased appendix including the carcinoma. It follows naturally that the prognosis is better than it is in carcinoma of the colon, because the lesions are smaller when they are removed. Histologically, this carcinoma may be differentiated, producing well formed glands. On the other hand, the carcinoma may be quite undifferentiated and produce signet ring cells. Usually variable amounts of mucus are produced by the neoplastic cells." These authors went on to say that extra care is needed in the excision of this type of carcinoma because it frequently involves the base of the appendix, occasionally extending into the cecum. They pointed out also that mucus production by the carcinomatous cells of the appendix is apparently significant, although not observed in all true carcinomas of the appendix, differentiating them from carcinoids. On sectioning the adenocarcinoma, it will be found whitish to grayish, whereas a carcinoid has a typical yellowish hue. Microscopically a carcinoid is obviously different, as can be seen by comparing the two photomicrographs here presented (Figs. 2 and 3).

DIAGNOSIS

Invariably the preoperative diagnosis is appendicitis. There are no signs or symptoms to suggest even the possibility of either an adenocarcinoma or a carcinoid. Although the gross appearance may be suggestive of either a malignant or a benign growth, microscopic study is necessary for accurate diagnosis.

TREATMENT

It should be obvious by now that, from a surgeon's standpoint, it is important to differentiate as soon as possible between a benign and a malignant growth in the appendix. If it is the latter, extensive radical intervention is indicated. Simple appendectomy is sufficient for a benign carcinoid.

REPORT OF CASES

H. T., a white man aged 57, was admitted to the clinic on Aug. 11, 1947, with a history and symptoms indicative of acute appendicitis. He had an oral temperature of 99.2 F. The leukocyte count was 11,400 per cubic millimeter of blood, with 63 percent polymorphonuclears, 1 percent basophils, 5 percent eosinophils and 31 per cent lymphocytes. Urinalysis gave negative results. Operation was performed on the same day. Through a McBurney incision the appendix was located. It was acutely inflamed and swollen and was attached by adhesions to the lateral abdominal wall. At the base of the appendix there was a small, hard swelling (Fig. 1b), approximately 1 cm. in diameter, which felt like an ordinary fecolith. The portion of the appendix distal to this tumor showed all the signs of obstructive appendicitis. Some inflammation was also noted in the cecum, and the tumor seemed to taper off into the base of the appendix. A routine appendectomy was performed. The patient was returned to the ward in excellent condition.

On readmission a right colectomy, with an end-to-side anastomosis of the ileum to the proximal third of the transverse colon, was performed. The patient tolerated this second procedure well, recovered uneventfully and was sent home in two weeks. He was seen recently in the follow-up clinic, four months after the operation, with no complaints and no evidence of metastasis. Fortunately the resected right colon showed no evidence of metastases as reported by the pathologist.

Fig. 2. Histologic appearance of appendix in Case 1. The pathologic diagnosis was adenocarcinoma.

Histologic Description: At the point of hypertrophy of the wall, the submucosa and muscularis were infiltrated by neoplastic tissue composed of cuboidal epithelial cells with scant cytoplasm and solidly staining hyperchromatic nuclei (Fig. 2). These cells were arranged in cords composed partly of single layers of cells and partly of double parallel layers, between which a lumen could be recognized. The cells were embedded in a dense collagenous stroma constituting a desmoplastic reaction. The invasiveness of the neoplasm was definite, but the growth was apparently localized. Permeation o

Fig. 3. Histologic appearance of appendix in Case 2. The pathologic diagnosis was carcinoid.

blood and lymph vessels could not be demonstrated. The *pathologic diagnosis* was adenocarcinoma of the appendix.

Case 2: D. N., a white girl aged 17, was first seen in this clinic on Feb. 2, 1947, with a typical history and symptoms of acute appendicitis of three days' duration. She had an oral temperature of 99 F. The leukocyte count was 10,000 per cubic millimeter of blood with 65 percent polymorphonuclears, 9 per cent eosinophils, 1 per cent basophils, 5 per cent monocytes and 20 per cent lymphocytes. She was taken to the operating room. Through a

McBurney incision a long, moderately inflamed appendix was removed in the usual fashion. The tip of the appendix contained a tumorous growth (Fig. 1a), which was yellowish on section. She made an uneventful recovery and was discharged from the hospital one week after the operation.

The pathologic report confirmed our gross impression of a carcinoid.

Histologic Description: The tumor was highly cellular, being composed of uniform cells possessing a moderate amount of fairly acidophilic cytoplasm and spherical nuclei with a moderate chromatin content, diffusely and solidly arranged. Division forms were not recognized. There was fairly rich capillary vascularity. The tumor was subdivided by slender fibrous septums. Very little stroma was present. In this location this neoplasm was probably not malignant. The pathologic diagnosis was carcinoid or argentiform tumor of the appendix.

SUMMARY AND CONCLUSIONS

A case of adenocarcinoma and a case of carcinoid of the appendix are presented and their salient features discussed. The authors offer the following conclusions:

1. The diagnosis is never preoperative.
2. The microscopic picture is distinct and diagnostic.
3. Simple appendectomy is adequate for carcinoid of the appendix, but a radical operative procedure is indicated for adenocarcinoma.

RÉSUMÉ ET CONCLUSION

Ces auteurs présentent un cas d'adénocarcinome et un cas d'appendice carcinoïde et discutent leurs caractères saillants. Ils en tirent les conclusions suivantes:

1. Le diagnostic n'est jamais fait avant l'opération.
2. L'examen microscopique permet un diagnostic précis.
3. La simple appendicectomie est le procédé de choix indiqué pour l'appendice carcinoïde, mais l'émploi d'un procédé radical opératoire est indiqué pour l'adénocarcinome de l'appendice.

RIASSUNTO

Presenta un caso di adenocarcinoma ed un caso di cancroide dell'appendice, discutendone gli aspetti diagnostici e terapeutici. Giunge alle seguenti conclusioni:

1—La diagnosi non viene mai posta prima dell'operazione;

2—Il quadro microscopico e' chiaro, sufficiente per la diagnosi;

3—L'appendectomia e' sufficiente per i cancroidi: un'operazione piu' radicale e' invece necessaria per gli adenocarcinomi.

SUMARIO

Se ha presentado un caso de adenocarcinoma del apéndice y otro de tumor carcinoideo del mismo órgano y se han discutido sus puntos salientes. El autor ofrece las conclusiónes siguientes:

1. El diagnostico operatorio al presente es un imposible.
2. El examen histo-patológico nos ofrece un diagnóstico positivo.
3. La apendectomía simple es suficiente en el tratamiento de los tumores carcinoideos de dicho órgano. En cambio los adenocarcinomas demandan un resección radical.

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Rectosigmoidectomy with Anastomosis in Carcinoma of Rectum and Rectosigmoid

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WHEN controversy exists on any subject, time usually reveals some merit on both sides. The passing years have proved this to be true in many phases of medicine and surgery. At present there is a wave of enthusiasm for preserving the sphincter mechanism in patients with carcinoma of the rectum and rectosigmoid. Extremists exist on both sides of the question, which is, in effect, as follows: Is an operation that preserves the sphincter mechanism radical enough to result in as high a percentage of cures as the more extensive abdominoperineal resection for cancer of the rectum, rectosigmoid and lower sigmoid? Percentages of five-year cures following radical abdominoperineal resection are frequently reported, and 55 per cent would seem to be a fair average, although some authors report as high as 70 and 80 per cent. Many variables exist in percentage figures on operability, resectability, mortality and cure. Some authors make too many reservations in reporting their figures, and theirs are the more optimistic estimates. Again, a lesion that one surgeon calls nonresectable may appear resectable to another surgeon; the difference may be due to technical considerations or to individual differences in handling malignant disease.

In evaluating figures on operability, resectability, mortality and curability, one must take many factors into consideration. It is not my intention to intimate that any of the figures presented are untruthful, but it is only human nature for some to present things in the best possible light and for others to be pessimistic. Unfortunately, this can alter the interpretation and evaluation of data.

Attempting to preserve the sphincter mechanism is not a new procedure. All early operations to eradicate carcinoma of the rectum were devised to maintain sphincteric function. It is believed that Lisfranc[1] in 1826 was the first to extirpate a carcinoma of the rectum; after a circular incision and excision, he brought the rectum down to the sphincter area and the anal skin. Modifications of this operation followed. Hartmann[2] advocated anal dilatation, circular section of the rectum below the neoplasm, lowering of the rectum to make possible circular excision above the tumor, and attachment of the upper rectal segment to any remaining sphincter mechanism or skin. Other technics were developed, and, for better exposure, excision of the coccyx or a segment of the sacrum was advocated. By 1885, Kraske[3] had presented his posterior approach, removing the coccyx and a section of the sacrum, excising the rectal tumor with adjacent tissues and approximating the bowel ends by various methods. Several years later (1887), Shede[4] was the first to perform an abdominal colostomy before excising a tumor posteriorly and re-establishing bowel continuity. In 1888 Hochenegg[5] brought forth his theory of attacking the tumor posteriorly, excising the tumor and rectum, and pulling the sigmoid or upper rectum through into the anal site. Still attempting to preserve the sphincter mechanism, Maunsell[6] in 1892 designed a combined abdominal and perineal approach. The abdominal dissection freed the structures and enabled the surgeon to make a wider excision of tissues; the tumor area was then excised posteriorly, the anastomosis completed and the sphincter mechanism preserved.

In 1908 Miles[7] of England, appreciating the poor results obtained from various procedures for extirpation of rectal carcinoma, initiated his more radical procedure. From his interpretation of the anatomy of the lymphatics in this area as presented by Poirier, Cuneo and Delamere[8], he concluded that cancer of the rectum spread uniformly upward, laterally and downward. Since that time, more critical studies of the pathologic anatomy by

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others have proved that downward extension through the lymphatics is rather infrequent. Little attention has been given to McVay's[9] report in 1922 on the involvement of lymph nodes in 100 cases of carcinoma of the rectum. Although 47 of the patients had metastases to lymph nodes, in only 1 instance was a node involved below the lower margin of the lesion, and this was at a distance of 1 cm. Since then, other reports on node involvement below the lower margin of the lesion have been made by Wood and Wilkie[10] in 1933; Westhuer[11] in 1934; Gabriel, Decker and Bussey[12] in 1935; Gilchrist and David[13] in 1938; Coller, Kay and McIntyre[14] in 1940; Grinnell[15] in 1942, and Glover and Waugh[16] in 1944—a total of 607 cases, and in only 5 were there metastatic nodes more than 2 cm. below the lower margin of the tumor—an incidence of 0.8 per cent (Table 1). This low figure should receive consideration. In all resections for gastrointestinal carcinoma, one elects to transect at least 1 inch (2.5 cm.) below the lower margin of the lesion, and probably most surgeons attempt to transect 2 inches (5 cm.) or more below the palpable tumor margin. If one transected the bowel at least 2.5 cm. below the lower margin of the tumor in all cases of rectal and sigmoidal carcinoma and continued to be just as radical in removing tissues in the zones of upward and lateral spread, additional recurrence on the basis of this technic should be less that 1 per cent. If the tumor recurs locally, one can resort to radical abdominoperineal excision. In fact, one is more apt to pick up early local recurrences when the continuity of the lower part of the bowel is intact than when the entire area is filled with the scar tissue that forms after a radical abdominoperineal excision. Before the foregoing remarks can be considered conclusive, however, a few more years of experience and follow-up by a considerable number of surgeons will be necessary, as conclusions drawn from apparently sound anatomic, physiologic and pathologic data are sometimes proved by actual experience to be wrong.

In low anastomoses (at or below the peritoneal reflection in the pelvis) I use the open technic.[17] Elsewhere in the colon I prefer to do a closed anastomosis over the Rankin clamp. In my experience with low anastomoses the closed type has many more disadvantages than advantages, and when it is unsuccessful it is a more troublesome procedure. Also, one is apt to be less radical in removing areas of potential spread. The disadvantage of the open anastomosis is the possible escape of malignant cells that may be present in the intestinal contents or in the mucus. In operations on the breast, we are very conscious of implants in the operative area and great care is taken to

TABLE 1.—Carcinoma of rectum and rectosigmoid: Data in 8 series of cases*

Author	Year	Cases Studied	With Nodes 1 to 2 cm. below lesion	With Nodes 2 cm. or more below lesion
McVay	1922	100	1	0
Wood & Wilkie	1933	100	0	0
Westhuer	1934	74	1	0
Gabriel, Dukes & Bussey	1935	100	2	0
Gilchrist & David	1938	25	0	2
Coller, Kay & McIntyre	1940	33	1	0
Grinnell	1942	75	1	0
Glover & Waugh	1944	100	6	3
Total cases		607	12	5
Percentage			2.3	0.82

*By permission of the American Journal of Surgery.

prevent this complication. The viability of cancer cells is more marked than is generally appreciated. Unfortunately, depriving these cells of an intact blood supply or a secondary infection will not destroy them, as some have believed in the past. Therefore, in anastomotic procedures, extreme care is taken to prevent this complication.

In selecting patients for rectosigmoidectomy with anastomosis, one must not choose those in whom immediate mortality or later recurrence would seem, from present knowledge, to carry a higher incidence than with abdominoperineal excision. The operation is a little more difficult; potentially, at least, it carries a slightly higher mortality. One should hesitate to attempt an anastomosis in a very obese or heavy-set person, for whom the abdominoperineal excision is the better choice. For the poor risk patient, as judged by his general condition, abdominoperineal excision is less hazardous; again, colostomy followed by posterior excision or a radical abdominoperineal excision in two stages may be preferable. In some instances simple colostomy, electrocoagulation or radium treatment may be indicated.

It is always desirable to avoid a permanent colostomy. When feasible on the basis of present knowledge and experience in pathologic anatomy, one of the three following procedures is recommended:[17] (1) abdominal dissection with abdominal resection and anastomosis; (2) abdominal dissection with posterior resection and anastomosis, and (3) posterior dissection and posterior resection and anastomosis. My experience with the pull-through operation advocated by Hochenegg[5] and modified by Babcock[18] and Bacon[19] has not only been limited but has been unsatisfactory in that sphincter control has not been adequate. Possibly more experience with this technic might change my opinion, but at present I prefer some type of anastomosis.

Of the three anastomotic precedures just mentioned, abdominal dissection with abdominal resection and anastomosis seems indicated for lesions of the rectosigmoid or the rectum when the lower margin of the tumor is at least 3 inches (7.5 cm.) from the external anal margin.

The second method—abdominal dissection with posterior resection and anastomosis—is recommended when the lower margin of the tumor is at or below the 3 inch (7.5 cm) level but above the 1½ inch (4 cm.) level. Abdominal dissection assures radical removal of the upward zone of spread, and the posterior attack permits removal of the lateral lymphatic spread onto the levator fascia and muscle or any direct extension into these structures. One does not remove portions of this muscle and fascia when the procedure is accomplished entirely from within the abdomen.

The third procedure—posterior dissection with posterior resection and anastomosis, which is really a slightly modified Kraske operation employing modern technics—is not adequate for carcinoma of the rectum. However, it should be recommended occasionally as reducing danger for the aged, for poor risk patients and for patients in other special circumstances. It is recommended only for lesions below the rectosigmoid.

A few remarks on technic are indicated because of the changes brought about by experience. For several reasons I am convinced that a closed type of anastomosis is not satisfactory for lesions of the rectosigmoid and rectum. First, one is apt to be too conservative in transecting the rectum below the lesion in order to apply the clamps satisfactorily. Again, many pelvises are too narrow or the lesion too low to permit one to carry out the closed technic adequately; if the attempt is made and the technic fails, the procedure becomes extremely awkward. In the open method of anastomosis, the escape of infectious material is kept at a minimum, and, with the use of antibiotics, infection has not been a major problem. I am more concerned about the carcinomatous implants that may follow any such operation, either as droppings from the surface of the tumor during manipulation or as leakage of intestinal contents. The principle of the Papanicoloau test may be applied here, and it should make all surgeons more alert to the possibility of implants when loose carcinoma cells are deposited during operation for cancer.

To overcome leakage, either gross or minimal, I insert a rectal tube into the rectum just before the operation and remove all rectal contents by suction. Special clamps have been devised to minimize the escape of

rectal contents during transection when the procedure is accomplished entirely from within the abdomen.[20] The general principle is to place two short-nosed clamps about 5 cm. below the lower margin of the tumor, leaving a small space between the ends of the clamps. Then a clamp is placed just above them so as to block the upper segment completely. The rectum is opened first between the ends of the two lower clamps; a metal suction tube is immediately inserted through this opening into the lower segment, and all material is removed. The rectum is then completely transected between the upper and the lower clamp. In my opinion, this keeps escape of rectal contents at a minimum. The clamps on the lower segment are then replaced by long stay sutures.

In the anastomosis, the upper segment of bowel is first approximated onto the lower segment of five posterior catgut sutures, with the knots on the mucosal side to insure good inversion. A single anterior catgut suture is then inserted with the knot on the mucosal side. The anastomosis is completed with a layer of interrupted figure-of-eight silk sutures. Experience has taught me not to be too zealous in cleaning the fat tabs off the ends that are to be anastomosed. It is constantly kept in mind that a crushing clamp has previously been placed on the lower segment and the sutures are placed at least ¼ inch (0.64 cm.) from the transected margin. When the anastomosis is accomplished through a posterior or sacrococcygeal incision as in the second and third methods, a routine opening procedure is used, clamps being used to prevent spilling.

I prefer to decompress the colon by means of a tube cecostomy, using a large mushroom catheter. No fecal drainage occurs after removal of the catheter if the mucosa of the cecum has been properly inverted around the tube and the cecum fixed to the parietal peritoneum. A cecostomy appears to offer better decompression than nasogastric or nasointestinal suction, and certainly it is more comfortable for the patient. Some surgeons prefer a proximal colostomy, but I do not think this necessary, and it does require another operative procedure for closure.

In all low anastomoses in which the peritoneum of the pelvic floor is closed above the suture line, I establish drainage of the presacral space by placing a drain in the hollow of the sacrum and delivering it posteriorly through a small incision along the coccyx. Care is taken not to place the drain along the line of anastomosis. When the pelvic peritoneum is closed below the suture line, I do not establish drainage.

Of a series of 40 consecutive patients (Table 2) operated upon by myself, 34, or 85 per cent of the tumors were considered operable. In

TABLE 2.—Carcinoma of rectum and rectosigmoid: Analysis of 40 consecutive cases

	Cases	Operation*	Resection*	Anastomosis†	Abdominoperineal Resection†
Number	40	34	30	25	5
Percent		85	75	83.4	16.6

*Percent of total.
†Percent of resectable lesions.

Mortality rate in 30 cases of resection

Total Deaths	Deaths with anastomosis	Deaths with Abdominoperineal Resection
2 (6.6%)	2 (8%)	0

30 (75 per cent) the tumors were resectable. Of the 30 patients resected, anastomosis with preservation of the sphincter mechanism was accomplished in 25 instances (83.4 per cent), and abdominoperineal resection was done in 5 (16.6 per cent). There were 2 deaths, a total mortality of 6.6 per cent following resection. The 2 patients who died had undergone rectosigmoidectomy and anastomosis (mortality 8 percent). Sphincter control in the 25 patients with preservation of the sphincter mechanism was satisfactory in all cases except 2. One of the 2 patients, a woman 82 years old, had minimal leakage, but the sphincter had practically no tone. However, it appeared that sphincteric power was gradually improving. About three months after the operation, a small rectovaginal fistula developed. This, of course, made it impossible to determine the status of sphincter control. More recently, in this patient, an abdominal mass consistent with carcinoma has developed. The other patient, a man 68 years of age, has a rather atonic sphincter; leakage occurs if there is a tendency toward loose stools. In 2 other patients the sphincter is rather atonic to digital examination, but control is satisfactory.

Among the male patients in whom the sphincter had been preserved and where frank discussion had revealed some sexual activity prior to operation, 2 volunteered some satisfactory inclination. It is well known that abdominoperineal resection practically always destroys sexual activity, regardless of the patient's age. Detailed interrogation of more patients will be necessary before this factor can be evaluated, but apparently, among patients who have a rectosigmoidectomy with anastomosis, there is less likelihood of complete destruction of sexual function.

After analyzing the anatomic lymphatics picture and the pathologic studies of removed specimens, one cannot help but feel that the figures on the percentage of cures may be quite similar. Certainly the evidence is sufficient to warrant further effort and experience in preserving the sphincter mechanism. One cannot justifiably compare the figures on morbidity, mortality and curability after operations for carcinoma of the rectum and rectosigmoid done twenty-five years ago (or more) with those done in the last decade. Not only have we made advances in technic and in preoperative and postoperative care, but antibiotics have contributed much to surgery in general, and knowledge of blood chemistry has advanced; also there is a much clearer understanding of the pathologic-anatomic picture of carcinoma of this section of the gastrointestinal tract. Even though the percentage of cures should range a little higher with operations that destroy all semblance of a sphincter mechanism and require the patient to carry an abdominal colostomy, it is my opinion that the patient should have some choice in the matter and be permitted to take the chance if he wishes. Again, after operations for restoring rectal continuity and preserving the sphincter mechanism, one has an opportunity to check the area for local recurrence; if it does take place, radical abdominoperineal excision can still be done. I have recently had such an experience. The patient was subjected to a radical abdominoperineal resection twenty-two months after a rectosigmoidectomy with anastomosis. There was no evidence of metastasis to the liver or of pelvic lymph node involvement. There was no evidence of local recurrence at the site of anastomosis, 3 inches (7.6 cm.) above the sphincter level, but there was a small mass of rectal carcinoma about 1 inch (2.5 cm.) below the line of anastomosis. This area was covered by normal mucosa and was thought to be a neoplastic implant from the primary tumor. With radical abdominoperineal excision one has no opportunity for direct examination of the rather large space previously occupied by the rectum, and implants or recurrent carcinomatous masses do not make themselves known until the mass is very large, until invasion of other structures has taken place or until metastases have developed and the condition is hopeless.

SUMMARY

Proper evaluation and comparison of the relative curability of radical rectosigmoidectomy with anastomosis and preservation of the sphincter mechanism and that of radical abdominoperineal resection must be postponed for a few years. Continued investigation and experience are warranted, since the limited reports at this time are favorable.

SOMMAIRE

On ne peut raisonnablement faire une évaluation et une comparaison entre les resultats définitifs donnés par la rectosigmoïdectomie radicale avec anastomose et conservation des éléments du sphinctér et ceux donnés par la résection radicale abdominopérinéale. Il est nécéssaire d'attendre encore plusieurs années, avant de se prononcer, attendu que les recherches continuent et que les rapports qui sont à notre disposition sont encore limités.

RIASSUNTO

Ritiene che la scelta fra rettosigmoidectomia con anastomosi e conservata funzione dello sfintere, e resezione radicale addomino-perineale non sia ancora possibile, perche' le statistiche sono troppo limitate e di data recente. Solo ulteriori indagini ed una piu' larga esperienza clinica potranno decidere quale delle due operazioni sia preferibile.

SUMARIO

El juicio final sobre el valor de la rectosigmoidectomia radical con preservacion del mecanismo funcional del esfincter, en comparacion con la reseccion radical abdomino-perineal, debe de posponerce por unos anos mas. Aun se debende continuar las investigaciones con estos procedimientos, por cuando las estadisticas del presente son limitadas y favorables a los dos.

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Modified Treatment of Appendical Stump

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SINCE the first appendectomy was performed by Kronlein[1] in 1884 and later deliberately and successfully by Morton of Philadelphia in 1887, the treatment of the appendical stump has always been an important problem. As a matter of fact, many technics, modifications and remodifications have been devised since then, but even now there seems to be no procedure that appeals equally to all discriminating surgeons. It may be said without exaggeration that there are as many technics of treating the stump as there are surgeons performing appendectomies. It is the purpose of this paper to review briefly the most common technics in use today, to point out their advantages and disadvantages and to describe fully a technic which, although a modification of the nonligation and inversion method previously performed by Ochsner and Lilly and later by Stratte, is in our opinion the most rational and the most advantageous and is attended by the fewest postoperative complications.

1. Simple Ligation, or "Tie and Drop" Method: This is the simplest of all the technics now employed and consists, as its name indicates, of ligating the appendix at its base, cutting off the organ and dropping the stump back into the peritoneal cavity with or without tying the mesoappendix over it. Although very easy and simple, this procedure is surgically unsound and particularly dangerous, because there is a possibility that the stump may blow out at any time and produce fatal peritonitis, a complication observed by Ochsner and Murray[2] several times, and also by Hilarowics.[3] Previous studies of the laws of adhesion formation have definitely established the fact that adhesions are almost certain to occur about any unperitonealized surface within the peritoneal cavity. Studies of appendectomies by Goode and Kregel[4] on experimental animals treated in this manner yielded the following results: 1. No healing took place until the slough beyond the tie was removed. 2. Examination of the cecum five days after the stump had been ligated, carbolized and dropped in the abdomen revealed a mass of adhesions joining the ileum or the omentum over the stump. When these were carefully separated they revealed either an opening into the cecum or an insecurely healed stump closed by a very thin layer resembling a spider web, through which, on gentle squeezing of the cecum, fecal material escaped. 3. It was noted that there is always a possibility that appendicitis may recur when the stump has been treated in this manner, because too long a stump has been left. Torek[5] pointed out the danger of postoperative adhesions and intestinal obstructions, citing two cases to prove his point. One of the patients died; the other was operated on, and the observations were the same in two cases. Ochsner and Lilly,[6] after an extensive and exhaustive study of the literature on the pros and cons of ligation and drop technic, summarized the objectionable features of this method as follows:

1. Closure of the bowel is likely to be inadequate, because serosa is not brought into apposition with serosa. 2. The ligated stump, which often is infected, lies free in the peritoneal cavity and can be a source of contamination. 3. Adhesions are likely to occur around the ligated stump.

Lilienthal[7] reported postmortem observations on three patients who died of peritonitis from three to six days after simple ligation appendectomy. Adhesions were observed in almost every part of the abdominal cavity.

Ochsner and Lilly[6] cited two cases of fatal peritonitis following simple ligation and drop technic. At autopsy an abscess was seen to have developed around the ligated stump, weakening the layers and causing infiltration of the cecal wall. After the administration of an enema the ligated stump blew up, permitting

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fecal contents to escape into the peritoneal cavity.

2. Ligation and Inversion Method: This so-called classic appendectomy, which consists of ligation at the base and inversion of the stump through a purse string at the cecum around the base, the mesoappendix then being tied over it, is the most common procedure and is still practiced by many surgeons. One of its modifications, now being performed by Estrada[8] and some of the resident surgeons in the Philippine General Hospital, is the addition of a re-enforcing secondary purse-string or figure-of-eight suture over the inverted stump before the mesoappendix is tied over it. We admit that this is much safer than simple ligation and far superior to it, but it is also far from ideal and is therefore objectionable. In the first place, it makes a closed sac of the appendical stump within the cecum, so that there is always danger of an intramural abscess. In a contaminated stump a localized suppurative process is prone to develop, which may rupture and become generalized. These complications have been observed and reported by several surgeons and investigators (Hartolomie,[9] De Martel,[10] Robertson[11] and Herman[12]). The danger becomes more apparent when one realizes the fact that necrotic tissue and abscess formation were observed in every instance in experimental animals examined on the fourth post-operative day, as reported by Kross[13] of New York and later verified by Yin and Lin[14] of China. Furthermore, experimentally and clinically, it has been found that adhesions are more extensive with this technic than with any others. We have also observed that many patients operated on in this manner complained of epigastric pain during the first few days after operation so distressing that they are forced to stay in bed in spite of orders to get up early. In addition, they usually come back for relief of the same right-sided pain several days or weeks after operation.

These two technics were condemned as early as 1889 and 1895 by Treves,[15] Morris,[16] Fowlers,[17] Eliot,[18] Dawborn,[19] Edibohls[20] and others, because of the danger of intestinal obstruction, adhesions and abscess formation in the cecal wall.

3. Intraluminary Invagination, or Inversion Without Ligation: Theoretically this is the best method, because there is serosa-to-serosa apposition without pocket formation in the cecal wall. Experimentally, as done by Yin and Lin[14] in rabbits, it showed the best healing with few or no adhesions and with but little sloughing on the inside. Macroscopic and microscopic studies of the stump, as done by Barkley de la Camp[21] and by Lin and his associates, showed only small necrotic spots, no hemorrhagic spots and very few adhesions, if any at all.

Ochsner and Lilly,[6] after making an exhaustive review of the literature and weighing the advantages and disadvantages of the various technics, came to the conclusion that inversion without ligation is the ideal technic provided that the stump can be converted without contamination of the peritoneal cavity and that hemostasis can be adequate. They contended that the possibility of occasional but fortunately rare catastrophes contraindicates the use of these two technics, as they are neither surgically nor physiologically sound, and that, although in most instances the patient will recover, the morbidity is likely to be greater and the complications more frequent. They devised a technic called the "three-clamp method," in which the appendix, without ligation, is grasped at the base by three Rankin clamps, one above the other. The appendix is amputated between the upper and the middle clamp. By releasing the middle clamp and holding the stump on the resulting grove, the surgeon invaginates the stump through a previously applied purse-string suture around the cecum, after releasing the lower one. Bleeding is prevented by a loop made at the mesenteric attachment during the application of the purse string, and this takes care of any intramural branch of the appendical artery. Our only objection to this technic is the fact that, in addition to the difficulty of holding four clamps, including the one at the tip of the appendix, with one hand, there is danger of leakage from the unligated stump while the third clamp is being removed to exchange it for a small tissue forceps for inversion.

Another method is that advocated by Stratte,[22] who applied a granny knot at the base of the appendix, cut it between two Rankin clamps, invaginated the stump through a

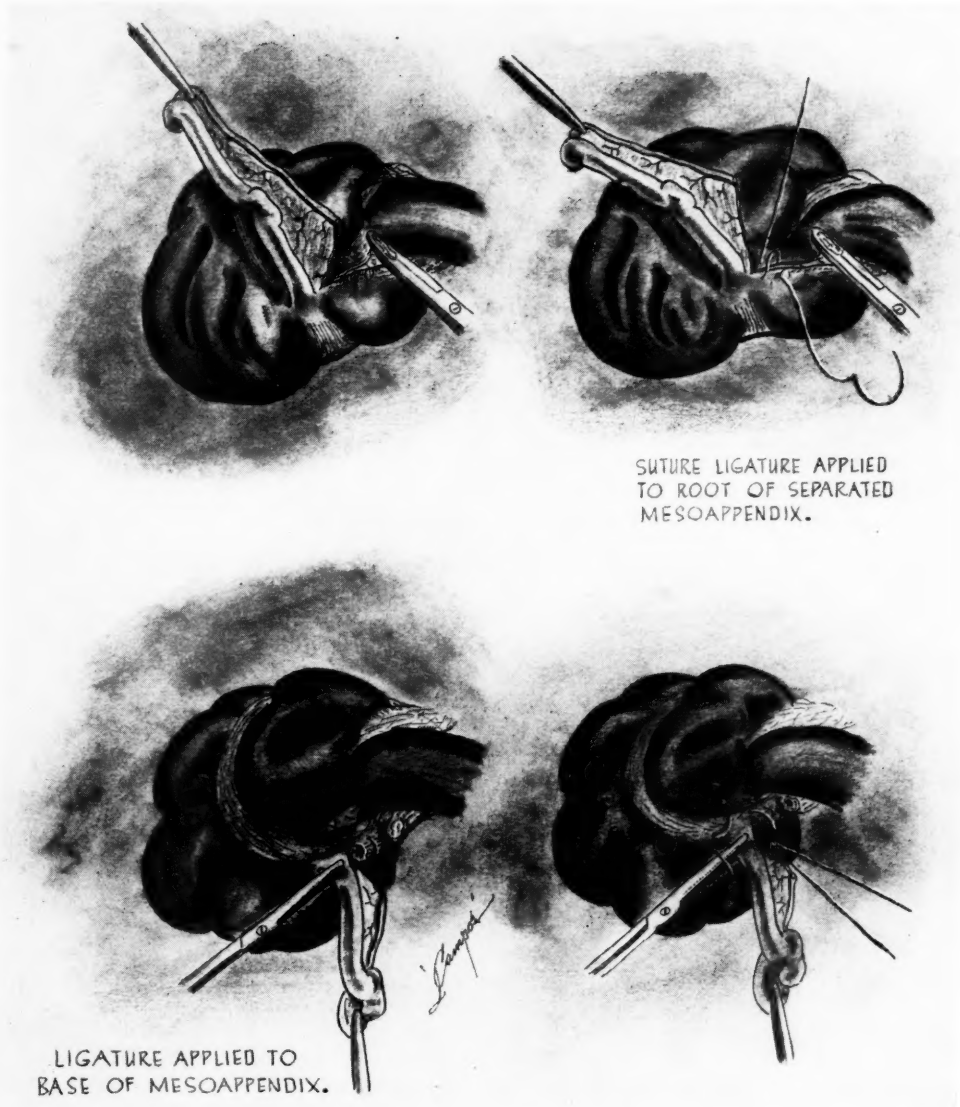

Fig. 1.—Modified treatment of appendical stump.

previously applied purse string suture around the cecum, and tightened the purse string while holding the first clamp vertically. This technic attempts to meet the intraluminary requirement by expecting the granny knot to give way into cecal lumen a few hours after operation. We doubt, however, whether this end is attained.

Authors' Technic: To obviate these difficulties and objections, we devised our own technic, which, although a modification of Stratte's, we have found ideal in that it ful-

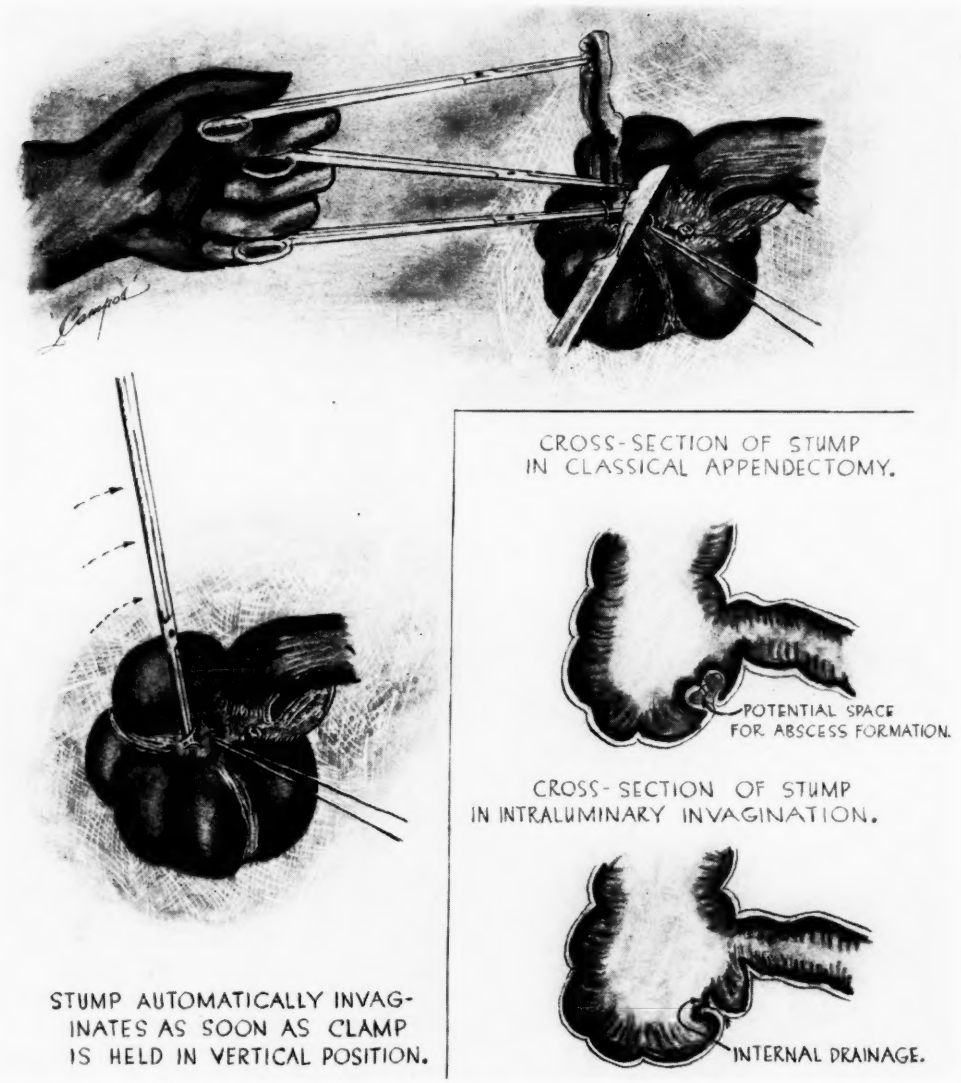
STUMP AUTOMATICALLY INVAGINATES AS SOON AS CLAMP IS HELD IN VERTICAL POSITION.
CROSS-SECTION OF STUMP IN CLASSICAL APPENDECTOMY.
POTENTIAL SPACE FOR ABSCESS FORMATION.
CROSS-SECTION OF STUMP IN INTRALUMINARY INVAGINATION.
INTERNAL DRAINAGE.

Fig. 2.—Modified treatment of appendical stump (continued).

fills the requirements of an intraluminary invagination—i.e., it does not produce a closed sac and intramural abscess—and it is simple and easy to perform. The mesoappendix is liberated and ligated in the usual manner, pains being taken to separate it up to about ¾ inch from the junction of the appendix and the cecum (Fig. 1). In this way one either cuts the intramural branch of the appendical artery and as such ligated or as an additional precaution if it escapes, a suture ligature is made at the cecum at its meso-

appendical attachment, about ½ inch from the base (Fig. 1). A small Rankin clamp is applied to the base of the appendix, close to the cecum and parallel or a little oblique to the anterior tenia, thereby avoiding the ileocecal valve. This clamp is applied with the point just reaching the opposite side of the appendix (Fig. 2). A purse-string suture is then applied but upon reaching the base of the clamp, instead of going under as usual, the string is carried over as in Figure 3. After the initial loose knot is made, an Ochsner clamp is applied just above the Rankin. The surgeon holds the appendix taut and steady by grasping the clamp applied to the tip of the appendix with the thumb and index finger of his left hand, the Ochsner clamp with the index and middle finger, and the Rankin clamp with his ring and small finger (Fig. 2). The appendix is then cut between the Ochsner and Rankin clamps, and the stump is carbolized and neutralized in the usual manner. The operator then swings the Rankin clamp into a vertical position with his left hand while his right hand holds another Rankin clamp ready to grasp the stump in case it refuses to invaginate. At the same time the assistant tightens the purse string while he withdraws the clamp with a gentle to-and-fro motion. It is our experience that as soon as the clamp is held in a vertical position the stump automatically invaginates (Fig. 2). We apply a second purse-string or figure-of-eight suture over the buried stump.

This technic is applicable to all forms of appendicitis when the base and the cecum are intact or only slightly edematous. If the appendix is gangrenous or friable and the cecum is only slightly and acutely inflamed, we modify it a little in that, instead of the usual purse string, we bury the stump by applying a Parker-Kerr suture over the Rankin clamp and gradually withdrawing the clamp while the suture is being tightened. In the presence of more advanced conditions, however, when this procedure cannot be followed, we still recommend the ligation and drop method as the procedure of choice.

We have applied this technic in 827 consecutive cases since 1946, and we have observed no untoward postoperative symptoms. Early ambulation could be ordered without complaints. There was not a single mortality, nor was there a single case in which a sinus, a fistula or any other postoperative complication developed.

The only complication one may fear with this technic is postoperative bleeding from the accessory appendical artery, which may be present along the wall of the cecum at its mesenteric border. However, Ochsner and Lilly, in their studies of cadavers, showed that only 15 percent of patients have this accessory artery, and this is well taken care of in our technic by applying a returning suture at this region to include the submucosa during the application of the purse string and a separate figure-of-eight suture ½ inch beyond the base at the cecal mesenteric border.

In our series, like those of Yin and Lin and Ochsner and Lilly, postoperative bleeding did not occur as a complication.

SUMMARY

1. A modified technic of intraluminary invagination of the appendical stump is presented.

2. We have found this technic simpler, easier and safer than classical and other technics used in treating the appendical stump. Several investigators and surgeons have shown experimentally and clinically that with this technic there are more advantages and fewer postoperative complications than with any other.

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Androgens in Incurable Breast Cancer

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ANY surgeon treating cancer of the breast inevitably comes to the day, a few years after having done what he thought was a nearly perfect radical mastectomy, when the patient returns with distant metastases. The radiologist reports that the patient has had all the x-ray she can take, and a prescription is written for a narcotic with the words, *Exception 1, Article 117.*

Now, in some instances, we are able to administer temporary relief. Some patients gain weight, some have their pain relieved without the use of narcotics, and some return to gainful occupations for varying lengths of time. We are able to delay that day when we write the narcotic prescription. The use of large doses of testosterone is the method of temporary relief.

The first article on this subject appeared in European literature, in 1939. Loeser[1] made some observations while treating 2 women with testosterone because of their metrorrhagia. He noted a slowing in metastases from breast cancer while the patients were under testosterone therapy. Two years later he took two groups of rats having the same parentage and who were quite susceptible to developing breast cancer. In one group he implanted testosterone and the other group he used as controls. In the control group, 9 of the 12 died of cancer of the breast, while only 4 of the 10 in the implanted group died.

Ulrich[3,4] also reported in 1939 the treatment of advanced breast cancer with androgens.

In 1944 Fels[5] concluded that the hormone has no direct effect on the carcinomatous cells, but that it causes an extraordinary proliferation of fibrous tissue which impedes and blocks its extension.

Adair[6] and Herman[7] championed this cause with several favorable reports which have been backed by the almost unlimited facilities of the Memorial hospital, New York. We[8] published a preliminary report of our experiences with testosterone in far advanced breast cancer in the *Southern Surgeon*, March, 1948. This paper is the follow-up of that report.

The theories as to the actual 'modus operandi' are yet quite theoretical. Auchincloss[9] has reported on a patient developing cancer of the breast following large doses of estrogen; Heiberg[10] noted that the incidence of mammary cancer is higher in women during late menopause (when their cells have been under influence of estrogen longer); Herrell[11] reported that bilateral oophorectomy exerts a protective influence against breast cancer; Halberstaedter and Hechman[12] showed that irradiation-induced menopause exerts a favorable response in breast cancer metastasis. In October, 1948 Gregory[13] reported that monkeys developed cancer of the breast when given a certain virus if there was an excess of estrogen.

Hoffman[14] summarized the relationship of estrogen to the hydrocarbon carcinogens as follows: that both are growth stimulants and that apparently both can cause cancer in certain individuals—the estrogen in sex tissues only, the carcinogens in other tissues. Loeb[15] states that "estrin causes cancer formation in certain tissues because it acts as a specific potent growth stimulus on these tissues, and that its chemical relationship to some carcinogenic hydrocarbons is not the essential factor."

Apparently the following scientific fundamentals speak in favor of androgens in halting breast cancer growth. Certain mice probably develop cancer[2] when very large doses of estrogen are administered. In humans too much estrogen may lead to benign changes,[16] i.e., chronic mastitis. Estrogen either alone or in combination with other forces may cause breast cancer in humans.[17] Certainly it causes an increased growth of sexual tissue[18] and since the cancer of the breast is of the sexual tissues, it causes its growth to be more rapid.[19] Testosterone in excessive doses causes a temporary block of the anterior pituitary and in this way halts production of gonadotropin, which

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in turn stops production of estrogen in the body. In our previous report[6] we showed that those individuals in whom androgens produced complete absence of estrogenic effect on the vaginal mucosa fared much better than those individuals who continued to show estrus effects. During the last two years we treated 20 women who had hopelessly far advanced carcinoma of the breast with varying amounts of testosterone. We noted many details in these cases and will present some of their more salient factors.

We divided them into two groups (table 1, 2). One group had some definite palliation; the second group either failed to improve or had only little help. It is hard, as you must realize, to predict with any degree of certainty what any individual case of far advanced malignancy will do so far as length of life, amount of pain and suffering—yet you can roughly prognosticate as to their course. We have been strict in our classification of these people. All of the patients placed in the palliated group must have shown real improvement, i.e., either voluntarily omitted morphine, gained considerable weight, stopped forming fluid in the abdomen or chest, shown recalcification of osteolytic lesions on roentgen examination, had lessening of activity of growth on biopsy, or shown a definite tangible evidence of a malignant ulcer becoming smaller.

TABLE 1—PALLIATED

	Name	Age	Meno	Type CA	Met	Estrog	MG Androg
1.	ERM	39	A	Sc	B		9,000
2.	ARP	45	43	Sc	B	0	6,500
3.	ALB	53	A		B-s	0	14,000
4.	JBS	55	45	Sc	S	0	10,000
5.	JWV	58	45	Di	S	0	2,000
6.	BC	64	45		B	0	3,000
7.	MS	65			B-s	0	1,500
8.	CMO	65		Di	B-s		9,000
9.	WCF	65	40	Di	S	0	1,500
10.	JWM	76			B		2,540
11.	BAF	75	48	Pag.	S	0	4,175

55% AV. 59

TABLE 1: Summarizes the palliated patients—shows age at beginning of treatment, age of menopause, type carcinoma, location of metastases, estrogen effect on vaginal mucosa after treatment and total dosage of testosterone.

TABLE 2—UNIMPROVED

	Name	Age	Meno	Type CA	Met	Estrog	MG Androg
1.	IM	36	A	Di	S		2,000
2.	CWF	41	A		S		1,760
3.	MH	43	A	Ad	B-s		2,000
4.	WCT	52	46	Sc	B-s		3,500
5.	RHC	54					600
6.	WWH	55		Du	S		2,000
7.	OLG (a)	55	43	Du	B-s		1,200
8.	EM	57		Sc	B-s		3,000
9.	LSF	59	53	Inf	S		4,000

45% AV. 50

TABLE 2: Summarizes the unimproved patients—shows age at beginning of treatment, age of menopause, type carcinoma, location of metastases, estrogenic effect on vaginal mucosa after treatment and total dosage of testosterone.

CASE REPORTS

Case 1: Female, age 55. She had a radical mastectomy because of scirrhous carcinoma in February, 1946. This was followed by 6000-r deep therapy. Early in 1947 her local physician gave her some estrogen which caused vaginal bleeding and shortly thereafter she began having pain in her hip. On admission, May, 1947, she had multiple metastasis to the pelvic bones (Fig. 1A). She couldn't walk because of her pain. She had almost complete relief after 500 mg. testosterone. In September she returned after receiving 3000 mg. She reported that she was working in the field every day digging potatoes. The x-ray showed some recalcification of the pelvic bones (Fig. 1B). Her blood calcium varied between 12 and 13 mg. percent after having been 8 mg. percent before beginning testosterone. Her vaginal smear showed absence of estrogen and her libido was increased a "right smart," so she said. In June, 1948 she returned saying that in the last three weeks she hadn't been feeling too well. She had a total of 6500 mg. and now had metastasis to the liver and lungs. She died in July, 1948, probably living longer, and more worthwhile without suffering because of testosterone.

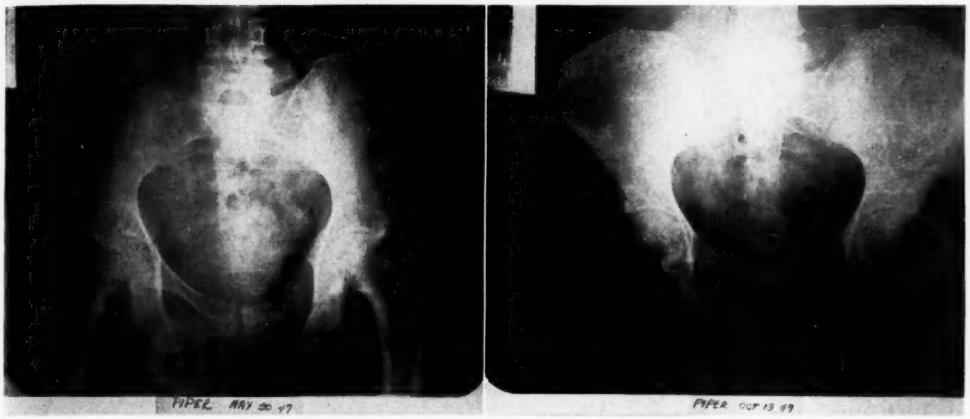

Fig. 1 (Case 1).—Left, pelvis showing osteolytic areas on left ilium. Right, pelvis showing increased calcification throughout.

Case 2: Female, age 39. This patient had a partial mastectomy elsewhere which revealed scirrhous carcinoma. She was referred to us in June, 1944 and a radical mastectomy was done. She had x-ray castration at that time, as well as x-radiation of the chest and axilla. In February, 1946 she had bony metastasis which was controlled by x-ray. She had trouble again in April, 1947, requiring crutches and morphine for pain. X-ray of her pelvis showed several osteolytic areas (Fig. 2A).

She received 50 mg. testosterone daily. She had complete relief after taking 450 mg., threw her crutches away and continued to gain weight. Vaginal smear showed slight estrogen activity. In August, 1947 her hip showed even greater destruction. She was advised to use her crutches against her will. In November, 1947 she had pain on movement of her hip. Her general health remained apparently good. She was seen again in October, 1948. She was bedridden, and had been in a wheelchair until recently with no particular pain. She had lost no weight, but had many osteolytic lesions of almost every bone in her body (Fig. 2B) and in recent weeks had begun the use of demerol at intervals. She had a total of 9000 mg. testosterone, and in November was the picture of health (Fig. 2C).

Certainly testosterone lengthened her life and made her more comfortable. During this course her calcium has remained near 10 mg. percent and phosphorus between 3 and 5 mg. percent.

Case 3: Female, age 65. She had a normal menopause at the age of 45. She had noticed a lump in her breast for some time and finally was brought to us in May, 1947 with terrific backache, which caused her to be bedridden. Examination showed a mass 4 x 4 cms. with typical orange peel skin of the breast and collapse of several vertebrae. She was placed in a brace and was given 50 mg. testosterone each day—with marked improvement and alleviation of her pain. Now she is working every day, still wears a brace, and there has been a reduction in the size of the mass, which now measures 1.2 cms. All of the orange peel appearance of the skin had disappeared. She received a total of 4000 mg. testosterone, which has given this lady 17 months of pain free, useful living.

Case 4: Female, age 55. She had normal menopause at the age of 45. In January, 1945 she had

Fig. 2 (Case 2).—Pelvis with osteolytic areas, especially on right ilium.

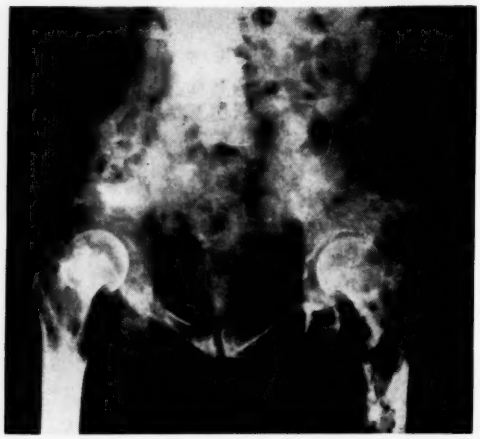

Fig. 3 (Case 2).—Roentgenogram showing complete destruction of pelvis.

a radical mastectomy because of a scirrhous carcinoma, followed by x-ray therapy. In October, 1946 she had pleuritic pain and her chest film showed a typical snow storm of metastatic carcinoma (Fig. 3A). She received maximum x-ray radiation, and by December, 1946 there was little change in her condition and she was started on testosterone.

After ten days her pain was gone and in the next month she gained 7 pounds. She began dieting to check her weight. She passed a kidney stone in February, 1947 at which time her blood calcium was 12 mg. percent. Her x-ray showed marked improvement (Fig. 3B).

In July, 1947 she talked us into stopping the testosterone, but within a month she developed fluid in her pleural cavity and on 50 mg. testosterone daily the fluid was reabsorbed in about two weeks. Her vaginal smear remained negative for estrogen. She worked at her regular employment from December, 1946 until April, 1948, when she had a return of chest fluid which was not reabsorbed even after more x-ray therapy. She died in May, 1948. Her complaints were shortness of breath and trouble swallowing. She never had any pain until just before her death.

Case 5: Female, age 53. She had a radical mastectomy on the right side in 1941. In 1945 she had a left radical mastectomy. In May, 1946 she was still menstruating and had abdominal metastasis with considerable fluid, which required that several thousand ccs. of fluid be removed by paracentesis every week. There were cancer cells in this fluid. She was given x-ray sterilization. She did very well until early in 1947, but by June she was entirely bedridden. Her last weight, before becoming bedridden, was 103 pounds. At this time she had lost more weight and we advised her to take 50 mg. testosterone daily. She now has had 14,000 mg. and weighs 160 pounds, has a male voice and whiskers. She says her libido is "like a bride." She is now taking 50 mg. twice each week as a maintenance dose. She has just returned from a trip North and is enjoying an apparently normal life.

Case 6: Female, age 65, menopause at 40. After having a mass in her breast for several years she finally consented to radical mastectomy because of a diffuse carcinoma. She had recurrence on the chest wall, and after the first few refused further x-ray treatment. When first seen she had considerable shortness of breath with fluid in her chest and a large ulcer on her left chest measuring 14 x 8 cms. She was started on 50 mg. testosterone each day, but took a bad cold and had considerable difficulty breathing. After a thoracentesis she did fairly well, her ulcer was clearing and becoming smaller.

During this time she had much family trouble. Her husband tried to commit suicide and while both were in the hospital someone burglarized her home. As a result she was upset, refused medicine and food. This was followed by her rapid demise. The ulcer at the time of her death was clean and measured 10 x 6 cms. A biopsy taken before beginning treatment and on the day of her death shows marked difference. Fig. 4A is a high power

Fig. 4 (Case 2).—General good appearance of patient at the same time the roentgenogram (Fig. 3) was taken.

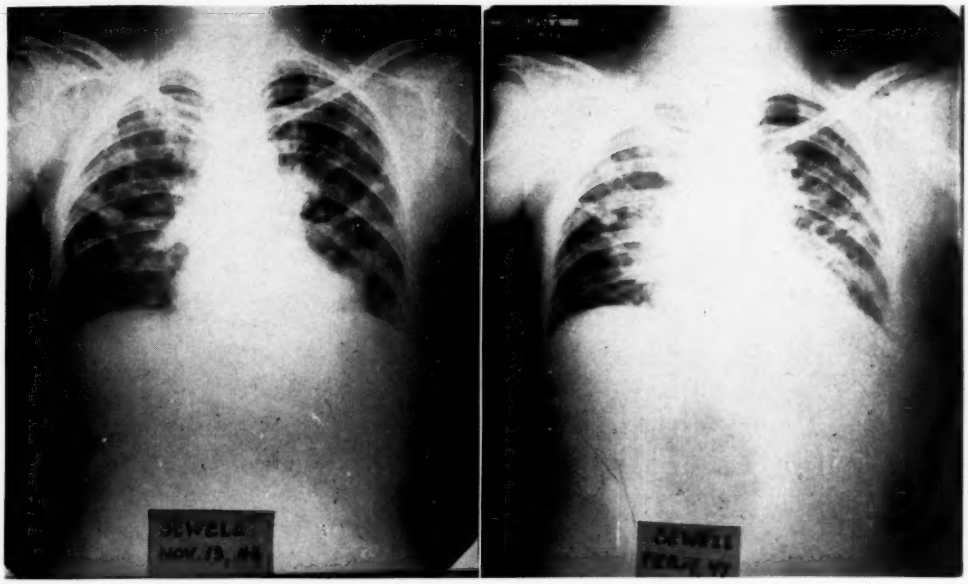

Fig. 5 (Case 4).—Left, typical "snowstorm" appearance of metastases to chest. Right, decrease of pulmonary metastases.

view before treatment showing large vesicular nuclei containing well defined nucleoli, while Fig. 4B is a slide after treatment showing the cells to be pyknotic and less active. This was after only 1500 mg. testosterone. Her vaginal smear showed no estrogenizing activity.

Case 7: Female, age 58, menopause at 45. She had a painless lump in her breast for sometime and finally it ulcerated and bled alarmingly. It was then that she sought medical attention. She had a dirty ulcer on the left breast measuring 12 x 14 cms. with nodes in the axillae, but no lung metastases. She was given 50 mg. testosterone daily. After 2000 mg. the nodes in the axillae were smaller, the ulcer was cleaner and smaller. A radical mastectomy was done to remove the offensive ulcer and the area skin grafted. She was given postoperative x-ray treatment and is doing fine at present. We believe that testosterone made her ulcer smaller and cleaner, yet microscopically the cells are still active.

Case 8: Female, age 36. She had a radical mastectomy for diffused carcinoma in August, 1947 followed by x-ray therapy and sterilization. In June, 1948 she showed metastases to the lungs. She has received x-ray treatment to the maximum, as well as over 2000 mg. testosterone, with no alleviation. Her vaginal smear has shown estrogenic effects on the vaginal mucosa constantly.

Case 9: Female, age 55. She had a radical mastectomy in June, 1943 followed by x-ray therapy. In May, 1948 she returned with abdominal pain and partial intestinal obstruction. She had a primary cancer of the cecum and metastases to the liver, which were histologically from the breast. She received over 3000 mg. testosterone without alleviation except that at first she gained some weight. She died in November, 1948 and her vaginal smear showed estrogenic effects throughout.

Case 10: Female, age 57. She had a radical mastectomy five years ago. In January, 1948 she noticed pain in her hip, which proved to be a metastases. She was given x-ray therapy. In March she suffered a pathological fracture of her hip, which was nailed with a Smith-Peterson pin. The next week we were called in consultation. Her blood calcium was 13 mg. percent. We felt that this might be due to the orthopedic procedures and started her on 50 mg. testosterone daily. After receiving 1500 mg. testosterone she had almost complete shutdown of her kidneys; her blood calcium was 16 mg. percent. Testosterone was omitted and fluids forced. Her urine returned to normal volume and by the end of the week her NPN, which had risen to 54 mg. percent, returned to 32 mg. percent. Her blood calcium dropped to 12 mg. percent.

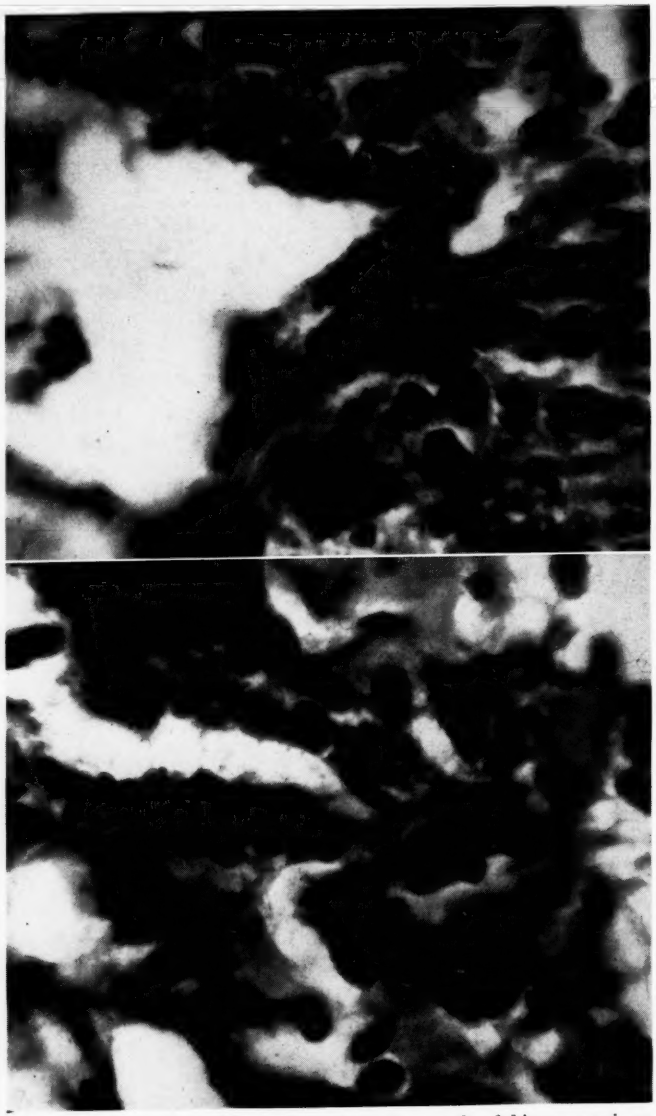

Fig. 6 (Case 6).—Top, high power photomicrograph of biopsy specimen before treatment. Most of the nuclei are large and vesicular. Nucleoli are present. Bottom, high power photomicrograph of biopsy specimen after treatment, showing increased fibrous tissue and pyknotic nuclei.

She was placed on Teropterin, but her course was steadily worse and she died about two months later. We believe the high calcium caused her low-reserve kidneys to suffer insult and shut down. Her vaginal smears showed estrogen activity in spite of the 1500 mg. testosterone.

Case 11: Female, aged 55, menopause at 43. The patient had radical mastectomy in May, 1944 for duct carcinoma, followed by postoperative x-radiation. In October, 1944, she developed metastases in her lung and spine, which were treated with 4700-r without effect. In February she was started on testosterone. Her course was rapidly downhill. She received a total of 1200 mg. testosterone before she died in May, 1947.

Case 12: Female, age 52, menopause at 46. She had undergone a radical mastectomy in December, 1946, because of scirrhous carcinoma. She had widespread bone and soft tissue metastases by March, 1947, and was started on 50 mg. testosterone per day. X-ray showed much destruction of her ribs. Her alkaline phosphatase was 7.4 Bodansky units. She had some relief of aching pain, but any respiratory movement caused considerable suffering. After 3500 mg. she still had distress and a new metastasis to her leg. The blood calcium 14.4 mg. percent, phosphorus 3.6 mg. percent, alkaline phosphotase 2.1 Bodansky units. A vaginal smear showed some estrogen response and she had some tibial edema. The x-ray showed some new bone formation along the line of destruction. She died in September, 1947.

Case 13: Female, age 59, menopause at 53. She presented herself to the clinic with a typical inflammatory carcinoma. She was given 4500-r and six weeks later there was but little difference in the breast except for post-radiation effect. She was given 50 mg. testosterone daily. After 1000 mg. the breast was markedly improved and after 2000 mg. the breast was soft except for brawny induration from her x-ray therapy. This breast was slightly heavier than the other and there was a vague suspicion of an ill-defined mass behind the nipple. The calcium was 11.8 mg. percent, phosphorus 3.1 mg. percent. The vaginal smear showed questionable estrogenic effect. Some of the desirable effect may have been due to her x-ray therapy instead of to the testosterone alone. She has received a total of 5000 mg. testosterone. In March, 1947, her malignancy rapidly grew and caused her rapid demise.

Out of the 20 patients here reported (table 1, 2) 11, or 55 percent, were grouped as palliated while 9, or 45 percent, were only slightly improved, showed no benefit or showed questionable deleterious effects. The outstanding feature in the difference in these groups, in addition to their clinical response, is the change in the cells of the vagina. When all estrogenic effect disappears it apparently means good results may appear. While in the individuals who show little or no change in the estrogen effect of the vaginal mucosa after the first 1000 mg., doubtful results may be expected.

The bony metastases respond much better than soft tissue metastases. The average age of the palliated group was 59, while the unimproved group was but 50.

There were larger amounts given to the palliated group, this being due to their improvement on the drug, which was continued over varying lengths of time, while in those who showed no response, the drug was soon stopped. There were several cases which we now feel were given insufficient amounts of drug. These were before we realized the importance of larger doses. Some of these cases were even given as little as 10 mg. orally each day to begin with. We feel that this was almost a waste of the drug.

It is our opinion that these patients who do respond are palliated until metastases to the liver become evident, then there is a rapid, short downhill course, which is just as devastating, yet is probably much less painful.

From our experience if a member of our family had metastases from breast cancer and if the blood calcium was within normal limits, we would give all the x-ray possible and start her with at least 50 mg. testosterone every day per hypodermic until she received 1500 to 6000 mg., then cut the drug to 50 mg. three times weekly, later cutting it to a maintenance dose that would keep the estrogenic effect on the vaginal mucosa negative.

SUMMARY

1. Testosterone does not cure cancer of the breast, but it apparently slows down the rate of growth in some individuals. In this series, 55 percent showed some degree of alleviation.

2. Palliation of the disease may be expected in individuals who respond to testosterone by showing a lack of estrogenic effect on the vaginal mucosa.

3. Individuals with bony metastases apparently are more prone to respond to this

form of treatment, and in some individuals there is a temporary recalcification of osteolytic areas.

4. Deleterious effects may follow if testosterone is given individuals who show an abnormally high blood calcium prior to starting treatment. This is the only contraindication we have noted.

5. Testosterone, to be effective, should be given in fairly large dosage. If the patient responds, the value received is well worth the cost involved. In the patient who has palliation, the testosterone should be continued in a maintenance dose large enough to prevent estrogenic effects of the vaginal mucosa. Hirsutism, deepening of the voice and increased libido are to be expected in these cases.

SUMARIO

1. Las preparaciones de testosterón no curan el cáncer de la mama, pero sí aparentemente aminoran su crecimiento en algunos pacientes. En esta serie, 55% de los pacientes mostraron cierto grado de (aliviación) alivio.

2. El efecto paliativo del testosterón en esta enfermedad, se puede anticipar en los pacientes que responden a su administración mostrando falto de efecto estrogénico de la mucosa vaginal.

3. Los pacientes con metástasis oseas, aparentemente, responden más favorablemente al testosterón, y algunos aún muestran evidencia de recalcificación temporal de las areas oseolíticas.

4. Efectos deletéreos que puedan seguir el uso de esta droga, generalmente ocurren en pacientes que tienen una tara alta del calcio del suero de la sangre, antes de la institución de este tratamiento. Por lo tanto, ésta es la única contraindicación que nosotros hemos notado.

5. Sólo las dosis elevadas de testosterón son efectivas. Si el paciente responde favorablemente (valor paliativo) se debe de continuar su administración en dosis suficientes para prevenir el efecto de los estrógenos sobre la mucosa vaginal. Es natural el esperar que estos casos sufran de hirsutismo y de otras manifestaciones de virilismo y de exageración del líbido.

RÉSUMÉ

1. Le testostérone ne guérit pas le cancer du sein, mais apparemment il en ralentit l'évolution chez un certain nombre de malades. Dans cette série de cas, 55% ont été quelque peu soulagés.

2. On peut attendre une amélioration de la maladie chez les malades qui répondent à l'administration de testostérone par une absence d'effet œstrogène sur la muqueuse vaginale.

3. Les malades présentant des métastases osseuses sont plus disposés à répondre à cette forme de traitement et dans quelques cas on observe une récalcification temporaire des zones ostéolysées.

4. On peut observer des conséquences fâcheuses, si l'on donne le testostérone à des individus présentant une teneur en calcium sanguin en dehors de la normale avant de commencer le traitement. C'est la seule contre-indication que nous avons observé.

5. Le testostérone, pour être éfficace, doit être administré à doses suffisamment importantes. Si le malade répond, le résultat que l'on obtient en échange vaut bien la dépense engagée. Chez les malades qui ont des améliorations, le testostérone doit être continué à doses suffisamment importantes pour empêcher les effets œstrogènes sur la muqueuse vaginale. On doit s'attendre dans ees cas à l'apparition de l'hirsutisme, de la tonalité grave de la voix, et à l'accroissement du désir sexuel.

RIASSUNTO

1—Il testosterone non guarisce il cancro della mammella, ma sembra ritardare in taluni pazienti lo sviluppo del tumore. Un'alleviazione dei sintomi si e' manifestata nel 55% dei casi curati dall'A.

2—Un effetto palliativo puo' essere previsto allorquando i pazienti rispondono al testosterone mediante la scomparsa di fenomeni estrogenici nella mucosa vaginale.

3—Rispondono meglio a questa terapia i pazienti con metastasi ossee: in taluni casi si stabilisce addirittura una ricalcificazione, sia pure temporanea delle zone osteolitiche.

4—Effetti dannosi possono risultare allo-

quando il testosterone vienne somministrato in presenza di un tasso eccessivamente elevato di calcio nel sangue. Questa e' la sola controindicazione segmalata dall'A.

5—Per riuscire utile, il testosterone va somministrato in dosi abbastanza elevate. Se l'effetto palliativo e' gia' stato raggiunto, la dose va mantenuta in quantita' tale da inibire sempre fenomeni estrogenici nella mucosa vaginale.

In taluni casi possono insorgere: insutismo, abbassamento del tono della voce, accresciuta libidine.

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Facts about the Transversalis Fascia
A Surgeon's Viewpoint

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KNOWLEDGE of the transversalis fascia is rather spotty. To most surgeons the transversalis fascia signifies and is coextensive with the aponeurotic sheath observed in the inguinal region. This is understandable when one considers that books on anatomy reluctantly allot one paragraph to graphic description of the transversalis fascia, and the description is limited to that segment of the fascia which is located in the inguinal region.

It should not be necessary to devote a paper to this subject. Wherever anatomy or surgical anatomy is taught, the transversalis fascia should be described in detail. However, if what is to be said of the transversalis fascia is true, certainly the transversalis fascia has possessed the property ever since the study of anatomy was born. Why teachers of anatomy have overlooked the coordination of this knowledge is inexplicable. It is the purpose, therefore, of this paper to describe in detail the distribution of the transversalis fascia throughout the body as observed in a large series of dissections on cadavers, to correlate the information and to point out the importance of this widespread abdominal tissue in the surgical repair of the abdomen and its contents.

Bassini was perhaps the first modern surgeon to call attention to the importance of the transversalis fascia. His descriptions of the inguinal canal and the repair of inguinal hernia rank as medical classics. As a consequence, the transversalis fascia in the region of the inguinal canal is generally appreciated from a surgical standpoint. The fibers of the fascia in this region are usually strong and well formed and constitute the posterior surface, or surgical floor, of the inguinal canal. There is little need to enlarge on the function of this inguinal fascia or on its relation to the production and repair of inguinal hernia. Every surgeon who has done inguinal herniorrhaphy has had experience with this fascia, irrespective of his specific knowledge of the structures of the inguinal canal. Here the fibers conify and thicken to produce the internal inguinal ring. They descend over the structures of the cord in a funnel-shaped manner to constitute what is known as the infundibuliform fascia. What has not received the emphasis it deserves is the fact that the infundibuliform fascia is also transversalis fascia (Fig. 1).

From the inguinal canal the fascia spreads laterally and upward. It ascends anteriorly over the entire under surface of the abdominal muscular wall until it meets the thin inner fascial covering of the muscles constituting the diaphragm. The fibers of the transversalis fascia thin out over the diaphragm and become intimately associated with the diaphragmatic fascia, especially the central part, to such an extent that it is extremely difficult to separate the two layers. This union is so compact, in fact, as to make almost a single structure of the two. Here one of the most interesting features of the transversalis fascia is observed. At each hiatal perforation where thoracic structures pass through to the abdominal cavity, fibers of the transversalis fascia encircle the perforating structures, forming a double conification not unlike the enclosure of the cord in the inguinal region. Some of the fibers ascend through the diaphragm into the thorax, producing an upside-down funnel reaching as high as 1½ inches (3.7 cm.) into the thorax. Other fibers descend along the perforating thoracic structure, likewise encircling it in a funnel-shaped manner. The teleologic aspect of such an arrangement is readily seen. It is a caulking off of the hiatal opening as an insurance against the penetration of either an abdominal viscus or a thoracic structure into one or the other compartment. Thus the aorta, the azygos vein, the thoracic duct, the esopha-

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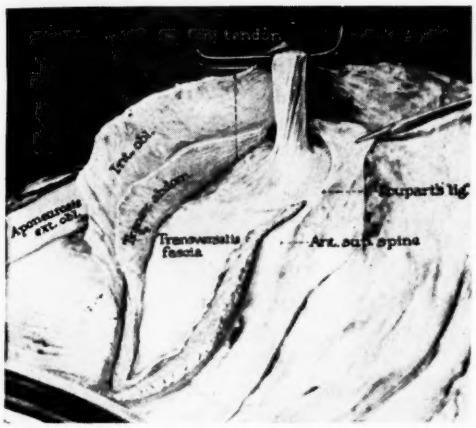

Fig. 1.—Anatomic drawing. Note that the infundibular fascia is continuous with the transversalis fascia.

gus, the vena cava, the two greater and lesser splanchnic nerves and the hemiazygos vein are all surrounded, insulated and walled off by the encircling process of the transversalis fibers, which doubtless accounts for the relative infrequency of diaphragmatic hernia (Fig. 2.)

At the xiphoid process the fibers of the transversalis fascia follow the attachment of the diaphragm and merge with the fibers of the falciform ligament of the liver. Posteriorly the fibers of the transversalis fascia descend over the diaphragmatic crura, giving sprigs of attachment to the lumbar vertebrae and their transverse processes, and merge laterally with the aponeuroses of the psoas major and the quadratus lumborum muscles. At a level superior to the adrenal glands the fascia splits off an internal sheath, which passes forward in front of the kidney and its vessel. Beneath the kidney the two sheaths again coalesce. Thus an encasement membrane of the kidney is formed, to which several specific names have been given. The most common of these names is Gerota's fascia (Fig. 3).

Obviously, from a surgical standpoint, it can be seen that a wandering kidney is the result of imperfect fusion or defective attachment of this specialized structural arrangement of the transversalis fascia. Consequently, repair of a dropped kidney presupposes an understanding of the structural arrangement, which determines the fundamental principle of kidney suspension (Fig. 4).

When dissection of the fascia is carried posteriorly into the pelvis, it is seen that the aponeurotic covering of the iliac fossa owes the greater part of its strength to the arrangement of the transversalis fibers. Because of the highly specialized character of this part of the body, all textbooks of anatomy go into considerable discussion of the fascia under the term "pelvic fascia." To tell the student that the pelvic fascia is also the transversalis fascia appears to be heresy, and consequently his memory and intelligence are strained to determine the purpose of the pelvic fascia and its relation to the other part of the body. To say that the transversalis fascia forms the tendinous arch or the "white line" of the pelvis (Fig. 5) is an unheard-of doctrine. Yet careful dissection will reveal the surprising continuity. Here the fascia separates into several conspicuous layers. The outermost layer is the fascial sheath of the obturator internus muscle, which is attached to the tuberosity of the ischium and is known generally as the obturator fascia. In the pubic area it fastens to the pubic arch and blends with the corresponding layer of the opposite side to form the posterior layer of the triangular ligament. The second or middle sheath, the ischiorectal

Fig. 2.—Artist's conception of the arrangement of the transversalis fascia about the diaphragm (from cadaver dissection).

fascia, lines the under surface of the levator ani muscle, whereas the third or innermost sheath constitutes the rectovesical fascia and extends downward and inward over the upper surface of the levator ani muscle, completely encapsulating this structure. It then invests the bladder, the prostate and the rectum. It is the anterior and lateral reflection, or true ligament, of the bladder. It is the capsule of the prostate and covers the seminal vesicles and ducts. Ascending, it attaches to the inferior border of the symphysis pubis.

In a woman this innermost layer, which connects the rectum and the bladder, is perforated by the vagina and the urethra, but here again, wherever perforating organs exist, the fibers conify and encircle them, sealing off all possible exit of the pelvic structures. It is apparent that a break in continuity of the fascial fibers may permit the escape of these structures and cause the formation of a perineal hernia, such as a cystocele, a urethrocele or a rectocele.

From this point of view, it is easy for the student to visualize an all-encircling membrane re-inforcing the abdominal cavity and providing insurance against perforations or penetrations, even though specific names are given to it in relation to the different regions in which it is found (Fig. 6).

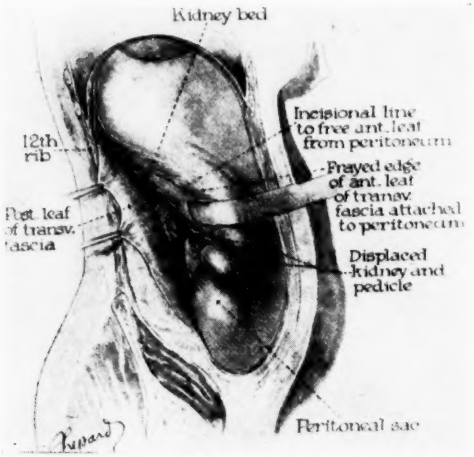
Kidney bed
12th rib
Incisional line to free ant. leaf from peritoneum
Frayed edge of ant. leaf of transv. fascia attached to peritoneum
Displaced kidney and pedicle
Peritoneal sac

Fig. 3.—Separation of the transversalis fascia to form Gerota's fascia of the kidney. (Courtesy *Urologic and Cutaneous Review.*)

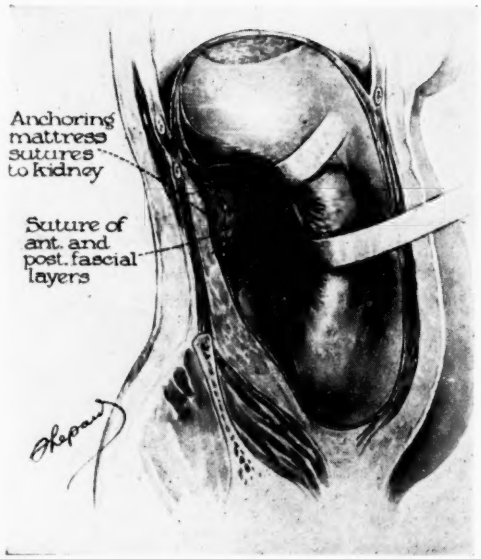

Fig. 4.—Nephropexy employing the sheaths of the transversalis fascia. (Courtesy *Urologic and Cutaneous Review.*)

When dissection is continued superiorly, the fibers are seen to ascend over the posterior surface of the symphysis pubis and merge laterally with the iliopectineal fascia.

At the crural arch the highly specialized function of walling off all potential avenues of exodus from the abdominal cavity is again demonstrated. The vessels and nerves that pass out onto the leg are encircled as in the diaphragm. The fascia splits into two divisions, one ascending along the structure and the other descending, completely insulating the vessels. The fascia, moreover, continues out onto the leg, contributing to formation of the fascia of that structure, and at the femoral ring a rosette-like arrangement of the fibers completely encloses the so-called empty space of the crural arch. Derangement of these fibers gives rise to femoral hernia.

On leaving the structures beneath the crural arch, the transversalis fascia gives off slivers of attachment to the inguinal ligament and then spreads out to form the surgical floor of the inguinal canal, as has been pointed out at the beginning of this article. Both halves of

the abdominal wall are included in the description, the fascia demonstrating a continuity far beyond the expectation of either the surgeon or the anatomist.

COMMENT AND SUMMARY

There may be some who will dispute the term "transversalis fascia" as applied to the all-inclusive structure described. This, however, is purely an academic question, and it is conceded to be a question for discussion. The fact remains, however, that there is a structure

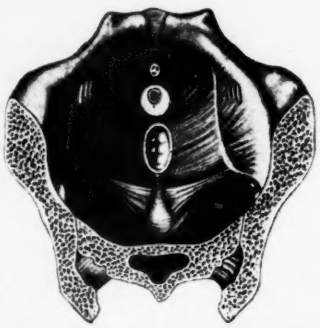

Fig. 5.—Relation of the "white line" of the pelvis to the pelvic diaphragm. (Modified from Campbell, W. F.: A Textbook of Surgical Anatomy, Philadelphia, W. B. Saunders Company, 1921).

in continuity with the structure admittedly called the transversalis fascia in the inguinal region. That this structure is distributed as here described is beyond controversy, whether one wishes to call it transversalis fascia, endo-abdominal fascia, intra-abdominal fascia, Gerota's fascia, pelvic fascia or any other name. The theory which restricts the transversalis fascia to the posterior sheath of the transversus abdominis muscle is definitely out of order and throws on its proponents the necessity of explaining, for example, the continuity of the fascia of the pelvis or of the diaphragm.

Pedagogically I reiterate, a step forward could be taken by considering the fascia as an entity, as a simple structural continuity to which specific names are affixed according to the specific location or function demanded of it. Assuredly it is against all principles of good pedagogy to fail to recognize the structure as a

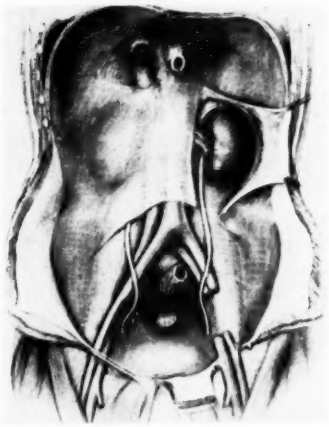

Fig. 6.—Artist's illustration of a dissection showing complete distribution and continuity of the transversalis fascia throughout the body. Note the encircling fibers about the structures that enter and leave the abdominal cavity. (Courtesy *Archives of Surgery.*)

unit, generally distributed throughout the abdomen and the pelvis. Furthermore, description of the fascia as a disjointed entity, separate and distinct, restricted to a specialized location and without continuity, begs the question and overlooks one of nature's most brilliant strokes of planned teleology.

RÉSUMÉ

Il y a des personnes qui discuteront l'emploi du terme "fascia transversalis" pour désigner la partie anatomique ainsi décrite. Ceci est apparemment une question académique et peut permettre la discussion. Néanmoins, le fait évident est qu'il y a une partie anatomique en continuité avec l'e'lement anatomique généralement désigné sous le nom de "fascia transversalis" dans la région inguinale. Comme l'existence de cet élément organisé, comme nous le décrivons, est admise, qu'on la désigne sous le nom de "fascia transversalis," "fascia endo-abdominal, fascia intra-abdominal, fascia de Gérota, fascia pelvien et autres dénominations, la théorie qui limite le fascia transversalis à la gaine postérieure du muscle abdominal transverse n'est plus discutable, ceux qui la

soutiennent se trouvent dans la nécessité d'expliquer la continuité du fascia du bassin et celui du diaphragme.

Je répète qu'il est désirable d'envisager ce fascia comme une entité, comme une simple continuité anatomique à laquelle des noms spécifiques sont donnés d'après l'emplacement ou la fonction qu'elle a. Vraiment, c'est contre tous les principes de bonne pédagogie, de ne pas reconnaître cette élément comme un tout, placé dans l'abdomen et el pelvis. Décrire le fascia, comme une entité disjointe, séparée, et distincte, limité à une emplacement spécial et sans continuité, est ignorer une des plus brillantes realisations de la nature.

RIASSUNTO

Sostiene che il concetto di limitare il termine di fascia trasversale alla fascia che riveste la faccia posteriore dei muscoli trasversali sia definitivamente superato, in quanto non puo' spiegare-per esempio-la continuita' con la fascia pelvica e la fascia diaframmatica. Nella regione inguinale esiste una fascia accuratamente descitta dall'A., che e' in diretta continuita' con la struttura comunemente denominata fascia trasversale. Questa fascia e' stata designata con i termini piu' svariati: fascia trasversale, fascia endo-addominale, fascia intraaddominale, fascia di Gerota, fascia pelvica, ecc.

L'A. ritiene che il termine di fascia trasversale comprenda una struttura complessa, distribuita generalmente a tutto l'addome e la pelvi: volendo sottilizzare, si potrebbe aggiungere a questo termine generica un suffisso, variabile a seconda della localizzazione e della funzione.

SUMARIO

Hay indubalemente, algunos autores que disputaran el uso del término "fascia del transverso abdominal" como designación de la estructura que se ha descrito en este artículo. Esto, sin embargo, es una cuestión puramente académica, y se concede que su uso invita a discusión. Por otra parte, no hay lugar a duda el hecho de que existe una estructura aponeurótica en la region inguinal, que es contínua con la fascia del transverso abdominal. Que esta estructura se distribuye tal como se ha descrito es innegable. No es de importancia el que se le de el nombre de fascia del transverso, fascia endo-abdominal, fascia intra-abdominal, fascia de Gerota o fascia pelvina, o por cualquiera otra designación. La teoría que restringe la fascia del transverso a la hoja posterior de este músculo no está en orden y presenta a sus exponentes con la responsabilidad de explicar, por ejemplo, la continuidad del tejido aponeurótico de la pelvis o de la superficie inferior del músculo diafragma.

Bajo el punto de vista pedagógico se debería de considerar a este tejido aponeurótico como una entidad definitiva, una unidad estructural que se extiende por el abdomen y la pelvis. Que reciba nombres específicos, según sus funciones locales, es permisible siempre y cuando se mantenga su unidad estructural. La desmembración de este tejido aponeurótico (fascia) en segmentos aislados implora la cuestión y falla de reconocer su verdadera naturaleza.

Case Reports

Atresia of the Duodenum in a Newborn Child

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CONGENITAL atresia of the intestine occurs more frequently than is realized. This particular anomaly is of interest to both the pediatrician and the surgeon, because successful treatment depends upon early operation. If the condition is unrecognized or neglected the patient will die within the first week of life from dehydration or peritonitis secondary to rupture of the distended and friable proximal loop of intestine. "The mortality for operative procedures on this entity is extremely high, and successfully treated cases are still rarities in the medical literature[1]." The following case of atresia of the duodenum in the newborn is added to the literature.

REPORT OF CASE

Baby G. was admitted to Children's Hospital, Denver, Colorado, on Jan. 11, 1947, three days after a normal birth. The obstetrician (D. M. M.) recorded that the mother had polyhydramnios. Shortly after birth it was noted that the baby vomited all of the liquids she had taken. The vomitus rolled out of the child's nose and mouth. It contained bile. The child's weight dropped from 6 pounds 10 ounces to 4 pounds 10 ounces. She had an icteric tinge. Physical examination revealed marked dehydration; the infant was breathing shallowly. The fontanels were sunken, and tissue turgor was gone. Examination of the heart and lungs gave negative results. The abdomen was distended and tympanitic. Most of the distention appeared to be in the left upper quadrant. Rectal examination revealed the presence of a soft mass felt with the tip of the finger through the cul de sac. A small amount of grayish inspissated stool was present on the gloved examining finger. Laboratory work revealed the following: The erythrocyte count was 6,100,000 per cubic millimeter of blood, and the hemoglobin was 18 Gm. per 100 cubic centimeters. The white cell count was 32,800, with 50 per cent granulocytes. The urine contained 100 mg. of albumen per hundred cubic centimeters. The sediment showed 8 to 10 white cells and 20 to 25 red cells per high power field. Farber's test was not done. A roentgen film of the abdomen with a catheter passed into the stomach (Fig. 1) showed a large collection of gas, presumed to be principally in the stomach and duodenum. No gas was discernible in the colon. A roentgen diagnosis of high intestinal obstruction was made by Dr. Frank B. Stephenson.

Hospital Course. The infant was placed in an incubator and given continuous oxygen. A continuous intravenous drip was started. Saline solution, dextrose and plasma were given intravenously. Nothing was given by mouth, and a catheter was passed into the stomach and attached to a Wangensteen suction apparatus. On Jan. 12 the abdomen was opened through a right rectus incision, and atresia of the third portion of the duodenum was observed (Fig. 2). The intestine proximal to the atresia was markedly dilated. The intestine distal to the atresia was completely collapsed, and the bowel was only 4 or 5 mm. in diameter. Intestinal clamps were placed on the proximal and distal portions of the intestine, and the distal collapsed intestine was distended with air forced into the lumen through a Luer syringe and a fine needle. A posterior duodenojejunostomy was done, two layers of 00000 chromic catgut suture being used. The abdomen was closed in layers with fine catgut, cotton, and deknatal suture material.

Postoperative Course. The infant's gastrointestinal tract was kept decompressed by continuous suction. Intravenous fluids were given. Nothing was given by mouth for the first forty-eight hours. The Wangensteen suction was gradually discontinued, and very small feedings of diluted breast milk were instituted on the second postoperative day. On the third postoperative day small amounts of milk were regurgitated. The vomitus had a deep bile stain. A roentgenogram of the abdomen on the third postoperative day revealed the presence of gas in both the small and the large intestine. On the fifth postoperative day the infant began to pass normal stools and to retain all of her food.

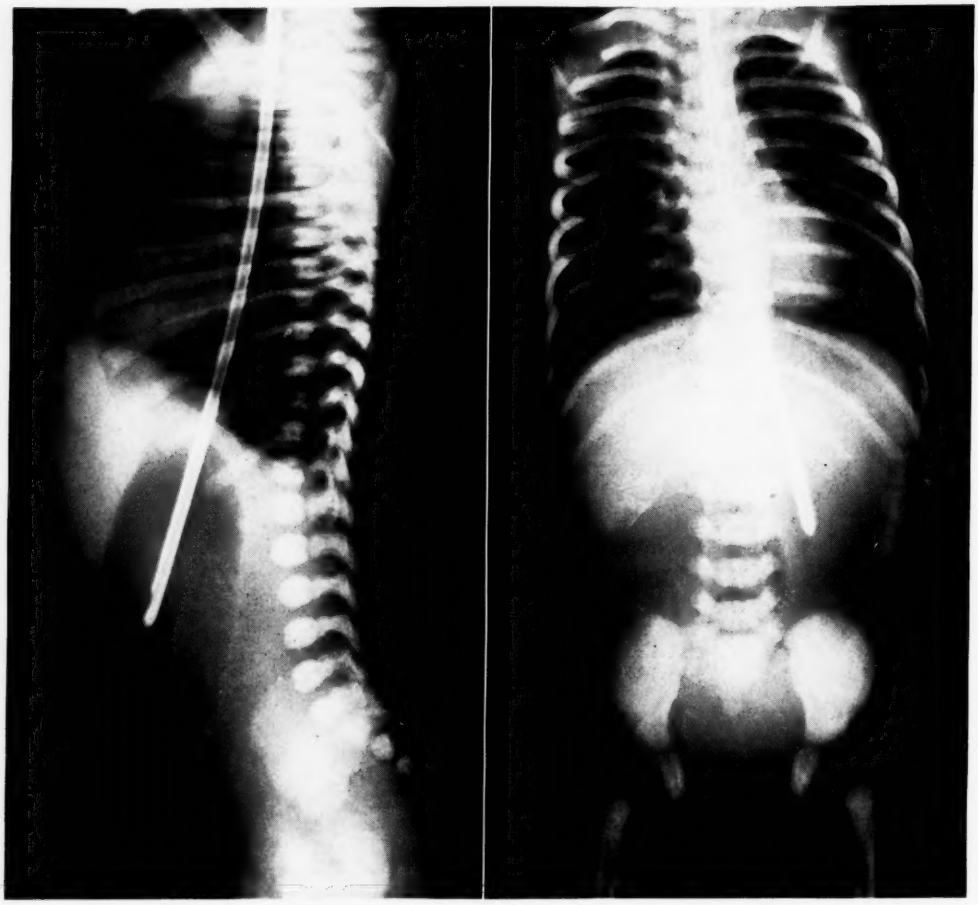

Fig. 1.—Preoperative roentgenogram of abdomen with tube in stomach, showing the dilated duodenum.

The formula was changed to evaporated milk, and she began to gain weight. On the day she was discharged from the hospital, Jan. 27, 1947, she weighed 5 pounds and 5 ounces. Her subsequent course has been entirely uneventful, and she is now a healthy, well developed child (Fig. 3).

COMMENT

Davis and Poynter[2] collected 392 cases of congenital atresia of the intestine. None of the patients recovered. Birgfield[3] in 1928 reported 194 cases. Of these, 58 were cases of atresia of the duodenum, 103 of atresia of the small intestine, and 33 of atresia of the colon. There were only 2 cases in which successful operations had been done up to that time. In 1933, Ladd[4] reported 6 cases collected from the literature and 8 of his own cases in which some surgical procedure had been satisfactory. Brunazzi and Lyon[5] were able to find 12 cases of atresia of the small intestine successfully treated and added 1 of their own.

The successful treatment of congenital atresia of the small intestine depends upon early diagnosis, aseptic restoration of gastrointestinal continuity, and meticulous attention to the patient's water and electrolyte balance.

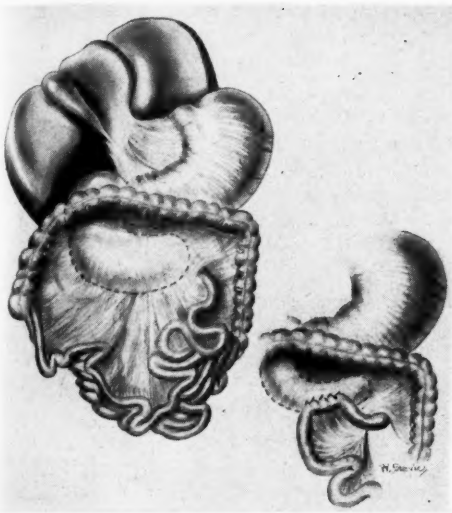

Fig. 2.—Artist's illustration of conditions observed at operation and of the corrective procedure.

The diagnosis is not difficult. The symptoms are those of intestinal obstruction; vomiting, pain, and some degree of abdominal distention. Vomiting begins immediately after birth and becomes progressively more voluminous as the interval increases. The nature of the vomitus depends upon the site of the atresia. If above the ampulla of Vater, it may consist only of the material ingested. If below the ampulla of Vater, the vomitus contains bile. Bowel movement as a rule is scanty. In questionable cases, the absence of characteristic epithelial cells in the stool, as demonstrated by Farber's test, is highly significant.

In small children, especially the newborn, pain is hard to demonstrate. However, close observation will reveal that the child is uncomfortable, and short periods of rest attest the intermittency of the pain. Some degree of abdominal distention is present in every case of intestinal obstruction. The amount, of course, depends upon the location of the obstruction. Distinct patterning is not infrequent. In the case reported here, most of the distention was in the left upper abdominal quadrant. An early diagnosis is greatly facilitated by a flat plate of the abdomen.

The observations of Paine and Nessa[6] with regard to the distribution of gas in the gastrointestinal tracts of infants are significant and valuable in making an early diagnosis of any complete obstruction of the bowel in a child. These workers pointed out that gas is present in the sigmoid colon or in the rectum within four to six hours after the birth of any normal child. A flat roentgenogram of the abdomen showing distended loops of bowel without gas in the colon and a negative result from Farber's test make it possible to diagnose atresia of the intestine any time after the sixth postnatal hour.

From the operative standpoint, the simplest procedure that will relieve the obstruction and restore the normal continuity of the bowel is

Fig. 3.—Baby G. at the age of 18 months.

the procedure of choice. For mechanical reasons, atresia of the third portion of the duodenum is best handled by an open posterior duodenojejunostomy. The distal loop can be distended with air or water, and an anastomosis (with two layers of 00000 chromic catgut) is easily accomplished. A closed anastomosis is impractical because of the minute size of the intestine, but any appreciable amount of soiling is fatal in these cases, the margin of safety being very narrow. Maintenance of fluid, electrolyte and protein balance is of extreme importance. In the case here reported, the attention given by the pediatrician and by the hospital staff to this matter was a most important factor in the successful outcome.

SUMMARY

A case of successfully managed congenital atresia of the third portion of the duodenum in a newborn is reported. Surgical treatment was limited to a posterior duodenojejunostomy.

RÉSUMÉ

On rapporte un cas d'atrésie congénitale de la troisième portion du duodénum chez un nouveau né, traitée avec succès. Le traitement chirurgical se limita à une duodénojejunostomie postérieure.

SUMARIO

Se ha reportado un caso de atresia congénita de la tercera porción del duodeno que fué tratado con éxito en el recién nacido. El tratamiento quirúrgico se limitó a la práctica de la duodeno-yeyunostomía posterior.

RIASSUNTO

Descrive un caso di atresia congenita della terza porzione del duodeno in un neonato. L'operazione, limitata ad una duodeno-digiunostomia posteriore, ha avuto un esito favorevole.

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Ischial Decubitus Ulcer with Atypical Features

A. ESTIN COMARR, M.D.
VAN NUYS, CALIF.

AMONG 120 surgical closures of ischial decubitus ulcers at this paraplegic center[1] an atypical bursal sac was found, of sufficient interest to warrant reporting.

The surgical closure of decubitus ulcers is of recent origin. A great number of decubitus ulcers have been seen in paraplegic patients since World War II. In the comprehensive literature there are only a few references to the ischial decubitus ulcer[2].

In a recent publication the etiology, anatomy, pathology, histology and surgical management of ischial decubitus ulcers have been discussed[1].

REPORT OF CASE

A 33-year-old white man was injured Sept. 15, 1943, by a shell fragment, sustaining a compound fracture of the twelfth dorsal vertebra. He underwent a laminectomy (from the twelfth dorsal to the third lumbar vertebra) shortly after the injury. At the time of his admission to this hospital, motion in the lower extremities was limited to some psoas and sartorius action on the left side, with even less motility on the right side. Besides a trace of abduction and adduction in both lower extremities in the hip joint, motion was lost below the hip joints. Sensation to touch was lost below a line between the eleventh and twelfth dorsal vertebrae on the right and on the left below a line between the twelfth dorsal and the first lumbar vertebra. Sensation to pin-prick was lost below a line between the eleventh and twelfth dorsal vertebrae bilaterally, and vibration sense was lost below a level of approximately the tenth dorsal vertebra. Additional neurologic observations included weakness of the right hand, due to residual conditions following severance of the right ulnar nerve at the medial bicipital sulcus at the time of injury to the spinal cord.

During the early part of September 1947 there was acute ischial bursitis, demonstrated by diffuse redness of the skin, heat and swelling. On aspiration, about 20 cc. of serosanguinous material was removed. Culture revealed alpha streptococcus and Bacillus proteus. Penicillin (200,000 units) was injected into the bursa. Thereafter, aspiration was done approximately every other day for a month, and each time approximately 10 cc. of the same material was obtained. During the following month the bursa was aspirated at intervals of three to four days. By the end of the second month the signs of inflammation had subsided and the patient was permitted wheel chair privileges. On December 4, nearly three months after onset of the bursitis, he was discharged from the hospital.

On September 15, 1948, the patient was readmitted for recurrence of the bursitis in connection with prolonged periods of sitting. On July 6 his family physician had incised the bursa for drainage, and since then it had been persistently draining.

Local examination revealed a large swelling over the left ischial area. There were no signs of acute inflammation. Pressure over the mass (which had a rather doughy consistency) caused clear serosanguinous material to escape from a sinus about 1 inch (2.5 cm.) superior to the gluteal fold.

Fig. 1.—Ischial bursal sac with structures resembling small bowel.

From the Paraplegic Service of Birmingham Veterans Administration Hospital, Van Nuys, Calif.

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Accepted for publication Dec. 9, 1948.

Operation: On October 6 a removal of the bursal sac was contemplated, in accordance with previous experience[1]. A transverse elliptic cutaneous incision was made around the sinus tract. When the sac was opened, a great deal of serosanguinous fluid with white shreds of necrotic tissue was exuded. The expected smooth-walled cavity was absent; instead, structures were present which resembled small bowel with several discrete loops (Fig. 1). Although a herniation of bowel was unlikely, the contents of the bursa were first carefully inspected and then the entire sac, with its contents, was dissected out and eventually freed from its bony (ischial) attachment. After removal of the sac the ischial bone was exposed; this revealed little, if any, pathologic change on inspection, which was in concurrence with the roentgen evidence. This resulted in a large defect of the soft tissue over the ischial bone. The bone was exceptionally prominent. In view of these two observations, a subperiosteal ischialectomy was performed (Fig. 2). Hemostasis was accomplished by electrocoagulation. After removal of the ischial bone the deep soft tissues were easily coapted by a few catgut sutures. The skin was brought together with four widely separated stainless steel wires in order to give adequate drainage. No drains were used. A heavy fluff pressure dressing was applied.

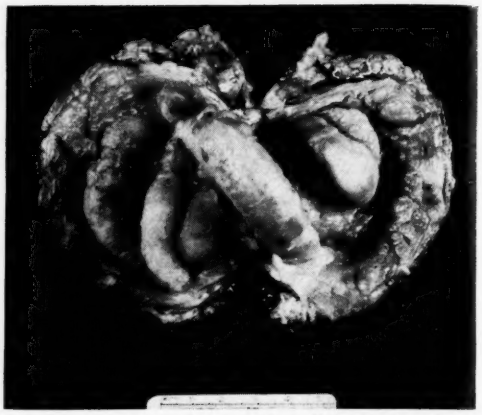

Fig. 3.—Bursal sac open with small arched bands in each hemisphere and one large arched band extending from one hemishpere to the other.

Fig. 2.—Roentgenogram taken after ischialectomy.

Pathologic Picture: The gross specimen consisted of a roughly spherical mass 8 cm. in diameter. Its color was gray to tan. Its consistency was firm and in parts rubbery and cartilaginous. The open sac seemed to contain a mass of small intestine (Fig. 3). An arched band 1.8 cm. in diameter extended from one hemisphere to the other. Three smaller bands were present in each hemisphere. Three papilloma-like growths, the largest of which was 1 cm. high, were visualized. The wall of the bursal sac reached a maximal thickness of 2 cm. The specimen weighed 161.5 Gm.

Microscopically, sections of the cyst floor revealed chronic fibrovascular granulation tissue. There was moderate infiltration by polymorphonuclear leukocytes. A section through one of the papilloma-like masses revealed well vascularized fibrovascular granulation tissue with foci of deposition of yellowish-brown pigment and occasionally areas lightly infiltrated by plasma cells, eosinophils and lymphocytes. A section through one of the intestine-like bands revealed well organized granulation tissue with prominent bundles of fibrous tissue and occasional small areas of fibroblastic proliferation and giant cell formation.

The bizarre structures encountered in the bursal sac consisted of granulation tissue with areas of necrosis and acute inflammatory infiltration.

COMMENT

Ischialectomy has become the method of choice at this center in the treatment of recurrent ischial decubitus ulcers. Twelve ischialectomies have been performed to date[1]. It is too early to compare the end results of this method with the number of cures achieved by a less radical procedure[1]. A comparison will be published when a comparable number of ischialectomies have been performed. The soft tissue closure in the ischialectomy follows our primary method[1].

SUMMARY

An ischial decubitus ulcer with an atypical bursal sac is described, the contents of which simulated loops of small bowel. Closure by radical ischialectomy is described. The gross and microscopic appearance of the specimen is described. The clinical importance of this extensive procedure is briefly discussed.

SUMARIO

Se ha descrito un caso de úlcera isquiática por decúbito complicada por una bolsa serosa atípica, cuyo contenido simuló segmentos intestinales. El tratamiento consistió de una isquialectomía radical. También se ha descrito el examen patológico de dicho espécimen. Finalmente, se ha discutido el valor clínico del procedimiento seguido en este caso.

RÉSUMÉ

Description d'un ulcère de décubitus ischial avec un sac en forme de bourse, son contenu faisant croire à l'enroulement de l'intestin grêle. On nous présente la fermeture par une ischialectomie radicale. Description de l'aspect microscopique de ce spécimen. L'importance clinique de ce procédé mutilant est brièvement discutée.

RIASSUNTO

Descrive un caso di ulcera da decubito dell'ischio, con una larga borsa a pareti atipiche: il contenuto di questa borsa, illustrato macro— e microscopicamente, simulava delle anse dell'intestino tenue. L'A. ha eseguito un'ischialectomia totale, discutendo l'importanza clinica di questa difficile operazione.

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Editorials

Physical Signs in Clinical Surgery

An Editorial Book Review

WHAT would happen to the modern clinical surgeon if he were suddenly deprived of his elaborate modern diagnostic equipment? It is hard to say; but it is safe to assume that, if he found himself still in possession of an indelible lead pencil, a magnifying glass, a couple of tape measures (linen and metal), an electric pocket flashlight, a pair of dividers, a wooden tongue depressor (or a spoon), a clinical thermometer, a box of matches and a patella hammer, plus a copy (in good condition) of Hamilton Bailey's "Physical Signs in Clinical Surgery,"* he would not do too badly.

This unique and invaluable work, now enjoying the well-deserved distinction of an eleventh edition, is as impressive as ever for solid common sense and even more impressive in format. To illuminate and substantiate his conviction that actual clinical experience and observation are the best grounds for clinical diagnosis, the author employs the best and most convincing of all proof—clear, actual and widely diversified photographs, many in color, of patients suffering from surgical disease. Even a layman, should he make close and careful study of this book, would emerge to some degree a diagnostician.

External discoloration, one of the most important physical signs of disease, is here plainly demonstrated in dozens of different aspects and in reproductions so accurate as to be startling. Mr. Bailey has not been satisfied with color photography, but has insisted on color photography brought to the peak of perfection. The localized paling of the skin, for example, in a case of tuberculosis of the knee, is clearly shown—no easy matter, photographically speaking. The gradations of color in a festering sore, the saffron skin associated with profound jaundice, the hideous green-black discoloration of gangrene—these are but a few of the color demonstrations which, in this book, are displayed as clearly as in the surgical ward or on the operating table. No condition in which discoloration plays a major rôle is without its colored illustration here.

Other conditions, in which the principal physical signs are abnormalities of posture, configuration and the like, are demonstrated by halftone photographs of equal perfection. Anatomic charts and line drawings are supplied when required, but by far the greater emphasis is placed on the photograph; in other words—and mark this well—*on the patient.* Not only Mr. Bailey's personal credo and his excellent text but his very illustrations, every one of them, thus emphasize a fact too often neglected—that the patient is paramount and that surgery exists to serve his need. Surgeons would do well to bear in mind the quotation that heads this book: "The wards are the greatest of all research laboratories."

These words, spoken by Sir Henry Wade in 1932, suggest an anxiety for the increasing dehumanization of surgical science. Has the tendency gained or lost ground since the words were spoken? Evidence can doubtless be adduced on both sides. Surgeons and specialists, who occupy the peculiar position of being the only jurors who are competent to pass judgment on themselves, might profit from a little self-searching here.

We tend to forget what issues lie in our hands. It is easy to forget them nowadays, with the patient and his woes half hidden from our sight in a jungle of instruments, records and hospital red tape. These things cannot be avoided in modern life, but the modern intelligence must take account of them. They must not be allowed to obscure the main purpose of surgery. The old-fashioned surgeon, who met and conquered a hundred handicaps an hour

*Physical Signs in Clinical Surgery. By Hamilton Bailey. Baltimore: The Williams and Wilkins Co., 1949. 11th ed.

by sheer force of his own ingenuity, had neither our opportunities nor our temptations; he could not forget his patient in his art, for his art depended almost totally on his knowledge of the patient and the evidence of his own senses. The ability to be guided by such evidence is not to be despised, and we are in danger of losing it if we lose sight of its essential and permanent importance.

There is great encouragement, then, in the appearance of an eleventh edition of a work based wholly on this enduring concept. If there were not among us thousands who face this fact, Hamilton Bailey's book could not have won and retained its immense popularity. Nowadays, both common sense and common humanity sometimes seem to the most optimistic among us to have reached a level so low as to invite despair; but despair is far from us while such books as this are written.

M. T.

Surgical Lectures, Old and New

An interesting little treatise on the surgical lectures of a hundred and fifty years ago has recently come to hand*. At that time, the author comments with a discernible touch of nostalgia, it was possible to cover practically the entire field of surgery in a set course of lectures. Surgery has grown, and this is not possible now. Nevertheless one must agree that the spoken word still has certain advantages over the written one. The easy, colloquial, conversational style of a good lecturer acts with immediacy upon the collective mind of the audience in a way that the most profound writing may fail to do.

Such masters of the lecturing art as Abernethy, John Hunter, Pott and Astley Cooper make interesting reading even today. Hunter's style is remarkable for its clearness, being almost reminiscent of a good teacher instructing children. On referred pain, for example, he observed:

> A diseased part may sympathize with a diseased part, or a sound part with a diseased part . . .

and on immunity,

> . . . the body, once affected by some stimuli, never forgets . . . and thereby is never again affected by that poison.

Abernethy's style was quite different from Hunter's but no less effective. He was dramatic rather than pedagogic, and sprinkled his lectures liberally with illustrative anecdotes from his own experience. Cooper was a pupil of Hunter, as Hunter had been a pupil of Pott; in both instances the pupil surpassed his master as a wielder of the spoken word. Cooper's lectures are still quite widely read, for they combine most of the elements that distinguished those of the other lecturers of the period—good pedagogy, good histrionics and sound scientific knowledge.

The lecture still has its place, of course, in surgery; but the field has widened so immensely that no single lecture and no single course of lectures can be simply a lecture on surgery. It must deal today with one or two facets at most of that many-faceted science. Still it is possible to infuse the lecture with the old vitality, and many famous surgeons are still able to achieve it. On the other hand, there are many to whom the lecture is only a duty, to be got through with credit but without enjoyment on the lecturer's part, and therefore, we greatly fear, without much of either enjoyment or profit on the part of the audience. An opportunity to lecture is an opportunity to grow; no man can teach others (if he puts his heart into it) and not learn something himself. Moreover, a genuine rapport between speaker and audience is one of the most delightful things in the world. There is nothing quite like it for solid satisfaction. Those old masters of surgery must have glowed with pleasure to see faces light up in response to a shared experience, a new idea, or a witty and telling thrust in controversy. Why should we be deprived of this charming by-product of our years of labor? We must specialize, true; but still we can speak our minds. We can still light candles of thought in the minds of others, and attract to ourselves the light that is in them as well.

*Surgical Lectures of 150 Years Ago. By V. Zachary Cope. Proc. Roy. Soc. Med. 41:353, 1948.

New Horizons

By the Editor

Health Conditions in Israel

The first 1949 volume of the *Hebrew Medical Journal*, which initiates its twenty-second year of publication, contains a number of highly interesting articles on health conditions in Israel today. These articles appear in the form of a symposium. Among the most important factual articles are "Errors and Faults in Diagnosis and Treatment of Infectious Diseases in Israel," by Dr. Moshe' Fischel; "Clinical Forms of Tuberculosis Among the Jews in Israel," by Dr. Rudolf Levy and "Public Dental Health in Israel," by Max Laufer, D.D.S. Dr. Fischel's presentation concerns itself chiefly with malaria, typhus and dysentery, the most prevalent infectious diseases in Israel, with emphasis on their different courses as compared with observations in the Western Hemisphere. Dr. Levy's article is also comparative, discussing tuberculosis among the Jews in Israel as it varies in incidence and nature from tuberculosis in other countries. Dr. Laufer's report on dental health is highly encouraging, announcing as it does the remarkable advances already made in this field.

For the collector of scientific curiosa and historical items, a section headed "Old Hebrew Medical Manuscripts" presents a unique article entitle "Poison, Charm and Love Potions Among Jews and Other Peoples," by Dr. Z. Munntner. In the *Personalia* section, Dr. Z. J. Plashkes of Tel Aviv comments interestingly on the first native Palestinian physicians, who were pioneers of medical progress in what is now Israel.

To the *Hebrew Medical Journal* and to its editor, Dr. Moses Einhorn, the *Journal* extends hearty congratulations on twenty-one years of service and on the fine issue beginning the twenty-second. The fortunes of Israel, late-born and promising nation among the nations of the world, are of the greatest interest to thinkers everywhere. There is no better sign of progress in any locality than the growth and maintenance of intelligent interest in health and medical advancement. This sign being plainly evident in Israel, we may look forward to further important developments in the near future and to an increasing solidarity and awareness of Israel's significance in the community of nations.

Opportunity for Service

The tragic plight of the Navajo Indians in Arizona and New Mexico, although somewhat alleviated since the general uprising of public opinion a few years ago, is by no means rectified as yet. Especially as regards medical and nursing care, hospital facilities and education in hygiene and sanitation, a great deal remains to be done. The Federal Government is active in the matter. "There is money available now for nurses and doctors," says Norman M. Littell, General Counsel for the Navajo Indians, "but there will presently be very substantial sums available for the development of hospital facilities on or near the reservation in Arizona or New Mexico. . . . A Navajo-Hopi rehabilitation bill has passed both Houses of Congress, and after several adjustments by the House and Senate will soon become the law. Of approximately $80,000,000 provided in this bill, approximately $4,750,000 is for these hospitals and hospital expansion during the next ten years." This is excellent news, but without sufficient professional personnel of a sufficiently high type it can come to nothing so far as results are concerned. The shortage of both doctors and nurses in the hospitals now existing is desperate. At the Fort Defiance Hospital, to give one example, thirty-five beds are unused and useless, and all members of the staff are so harassed by the pressure of

work that administrative problems cannot be met satisfactorily. Similar conditions exist in practically all of the hospitals now available to the Navajos.

The health, safety and civic usefulness of some 63,000 Indians is at stake. Where could a young physician or surgeon begin his career to greater advantage, as regards both experience and human values? Where could a nurse be better employed than here? What doctor or nurse, perplexed and troubled perhaps by the need of removing some member of the family to a drier climate, can find a better way of solving the problem and at the same time building a worth-while career in the service of others?

The Navajos are a strong, intelligent race, lacking only education and the discipline it brings to become extremely valuable citizens of our country. Mr. Littell gives it as his opinion that there is ample talent among them to fill all staff positions except those requiring the highest training. This possibility is not being overlooked, and it is planned eventually to establish a training school for Navajo nurses and other hospital personnel. Education, however, takes time, especially when the most meagre facilities are lacking; and in the meanwhile these people must be cared for. Surely it is not consonant with the dignity of our country or with the democratic ideal that any segment of our population, especially such a large one, should be neglected in matters as fundamental as health.

Posts available on the reservation are open to qualified citizen doctors and nurses under Civil Service regulations. A trained nurse receives a salary of $2975 per year. The salary range for doctors is from $5,000 to $6,000. The opportunity for experience and service is unparalleled, offering a challenge high enough to satisfy the most ardent. There is great interest, as well as great enlightenment, in working with a special racial group. The discoveries that await the earnest worker are not altogether medical.

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News Notes

British-American Exchange Fellowships in Cancer Research

The American Cancer Society, in conjunction with the British Empire Cancer Campaign, is offering British-American exchange fellowships in cancer research. Specialized training is provided for American investigators to study in Great Britain where there are opportunities that are not generally available in this country. An equal number of British scientists will be selected for training in the United States. The candidate must have qualifications to carry on the proposed study and applications may be submitted at any time to the Executive Secretary of the Committee on Growth, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

New Cancer Grants

Grants totaling $3,250,000 for assistance in construction of cancer research facilities have been announced by the Federal Security Agency. The University of Minnesota, the University of Chicago, the New England Deaconess, the University of Kansas, Johns Hopkins University, St. Louis University, New York Memorial, the University of California, and the University of Pennsylvania have all received a share in this gigantic program.

The American Heart Association's New Journal

In order to permit the printing of 25 per cent more material in each issue, The American Heart Association will publish, beginning January 1950, a new official journal known as "Circulation—The Journal of the American Heart Association." A new and larger format will characterize the Journal and all phases of scientific heart information for specialist, clinician, and investigator will be included.

Checklist Holdings of German Medical and Dental Periodicals

The Committee on Periodicals and Serial Publications of the Medical Library Association has compiled an Interim Checklist of Holdings of 168 German Medical and Dental Periodicals (1939-1948) in 38 libraries of the United States and Canada.

Remittance of $1.00 to Mrs. Edith Dernehl, Marquette University Medical Library, 561 N. 15th St., Milwaukee 3, Wis., will assure the sender of a copy.

National Cancer Hospital of America Ready Soon

The National Cancer Hospital of America is scheduled for opening in Detroit late in 1951, with a large share of the building funds already obtained through gifts. The hospital will be nonsectarian and national in scope.

Pediatric Congress

The Sixth International Congress of Paediatries will be held in Zurich, Switzerland, during the last ten days of July 1950. Further information may be had from the secretary-general, Prof. Emmett Holt, Bellevue Hospital, New York 16, N. Y., or the president of the congress, Prof. G. Fanconi, Kinderspital, Zurich.

Funds Available for Research on Lymphatic Leukemia

A fund of $25,000 from the estate of Charles R. Blakely for the support of research in the field of lymphatic leukemia has been made available through the National Research Council. Application forms and information may be obtained from the Chairman, Division of Medical Sciences, National Research Council, 21 Constitution Avenue, N. W., Washington 25, D. C.

American Alumni of British Medical Schools Incorporate

In order to serve more effectively the interests of its members, the American Alumni of British Medical Schools, organized in 1940, obtained incorporation recently under the laws of the State of New York. Doctors who took their degrees from medical schools of the British Commonwealth of Nations or the Irish Free State may join the organization by writing to Dr. Theodore Maltzer, secretary, 123 East 37th Street, New York 16, New York.

Eye Bank Established

The recent Congress of the Ophthalmological Society of the United Kingdom has created an eye bank for the purpose of accumulating and distributing corneal grafts. The resources will not be limited to corneal grafting, but will include items useful in the plastic repair for severe injuries of the lids and orbits, lacrimal obstructions, paralysis of extra-ocular muscles, new forms of enucleation with implantation and the application of modern prostheses.

New Books

A Short Practice of Surgery. By Hamilton Bailey and R. J. McNeill Love. Baltimore: The Williams and Wilkins Company, 1949. 8th ed. Pp. 1050; 1198 illustrations, including 280 color plates.

That a new edition of this highly valued textbook was in demand barely two years after the appearance of the last is evidence enough of its vital importance in the world of surgery. The authors have recognized and met the need for an absolutely up-to-date presentation and have even, after this short interval, found occasion to add one completely new chapter dealing with peptic ulcer. Other important changes and additions have been made.

The most striking alteration, perhaps, is the enrichment of pictorial content. Surgeons everywhere are familiar with Mr. Bailey's wonderful achievements in color photography and will find in these pages new reason for admiration. The accuracy of reproduction in color, even of the most difficult conditions to photograph, is almost beyond belief.

The general coverage of this work is too familiar to require description, but it is obvious even at a glance that no effort has been spared by the authors to improve what was already excellent and to elucidate modern technics with meticulous care. Too often a new edition of a successful work is done on the "once over lightly" principle, but in this instance it can be seen clearly that the authors have no inclination to rest upon their laurels.

The Sexual Criminal. By J. Paul de River. Springfield, Ill.: Charles C. Thomas, 1949. Pp. 281; illustrated.

An excellent short treatment of crime resulting from sexual abnormalities and aberrations, this book will be welcomed by physicians, the legal profession, and all students of abnormal psychology. Such perversions as sadism, masochism, bestiality, necrophilia, fetichism, etc., are described and clarified by case reports from the author's own experience. The appalling fate of the sexual criminal's victim is unforgettably emphasized by unaltered photographs taken immediately after discovery of the crime.

Dr. de River explores the apparent contradictions in the sexually psychotic personality, including as evidence several pages of poetry written by a sado-masochist. He also explores the significance of dreams, the use of "truth serum" in criminal investigation, the psychology of the female sadistic criminal, homosexual sadism and masochism and the so-called lust murder. The problems confronting the medicolegal expert in court are enumerated and helpfully commented upon.

The special value of a work of this kind lies in the fact that it is written from the standpoint of the individual personality rather than from that of the psychosis in general. It is therefore a convenient handbook for the general practitioner who has not time to cope with the usual massive textbook on psychiatry.

The Development of Gynecological Surgery and Instruments. By James V. Ricci. Philadelphia: The Blakiston Company, 1949. Pp. 594; illustrated.

An unusual and valuable book for the medical researcher, this history of gynecology from the dawn of recorded history well repays the reader for his time. There are many striking illustrations depicting instruments and devices used in gynecologic practice many centuries ago, some of them surprisingly ingenious in construction and all of them highly interesting.

That Dr. Ricci found the exploration a fascinating one is evident from the vigor and energy of his writing. "In medicine," he remarks, "ideas once formulated may seem to die out, only to quicken in subsequent, more receptive generations. A search for these original ideas has led to original sources, with the accompanying excitement and enjoyment of ferreting out priority. Since it is difficult, if not impossible, to convey the colorful and sometimes quaint phraseology of the old authors, it is hoped that the reader will be lured back to the sources." He is quite likely to be, for these studies are not only interesting, they are stimulating as well.

There is always room in the library for sound historical contributions to the medical literature. Not only does such a book as Dr. Ricci's provide interesting and provocative material for reading and study, but it helps to maintain the professional sense of continuity with the past, an element in the philosophy of healing that we cannot afford to neglect.

Abraham Levinson Anniversary Volume. Edited by Solomon R. Kagan. New York: Froben Press, Inc., 1949. Pp. 365; illustrated.

In recognition of his services to medical science as physician, teacher, author and researcher, this volume has been presented to Dr. Levinson by his colleagues in honor of his sixtieth birthday. It is

a fitting tribute to a distinguished man and a great pediatrician.

Dr. Levinson's portrait appears as the frontispiece, and a brief biographical sketch is included, together with a personal tribute in the form of a prefatory letter from Dr. Isaac A. Abt. The bulk of the volume, however, consists of scientific and literary contributions from Dr. Levinson's friends and admirers. There are four main divisions: *Pediatric Neurology and Psychiatry, Blood and Cerebrospinal Fluid, General Pediatrics* and *Medical History*. The last-mentioned division is a delight to the general as well as to the professional reader.

Blood and Plasma Transfusions. By Max M. Strumia and John J. McGraw. Philadelphia: F. A. Davis Company, 1949. Pp. 497; 124 illustrations.

The importance of transfusion has increased steadily since the day it was first successfully performed. As the authors of this treatise truly remark, "it has become almost a specialty." They approach the problem from a dual standpoint, the clinical and the technical, pointing out that a clinician and a laboratory man must work closely together for good results.

The book should meet a real demand, for it is both detailed and comprehensive. Not only the technical and therapeutic aspects but the practical management of blood and plasma services are discussed, with definite suggestions as to record-keeping and other matters of routine. There are many well-organized tables of pertinent data. Charts, graphs, line drawings and photographs are inserted where indicated, with appropriate comments by the authors.

Clinical Neurology. By Bernard J. Alpers. Philadelphia: F. A. Davis Company, 1949. Pp. 846; 240 illustrations.

The many experiences of World War II in the field of neurology and neurosurgery, especially with regard to peripheral nerve injuries and cranial trauma, have brought out information without which no modern textbook on neurology is complete. Dr. Alpers has therefore revised and enlarged his already successful text, including these wartime data and also bringing up to date his discussion of meningitis, syphilis of the nervous system, epilepsy and poliomyelitis.

Like the original work, this new edition is based on the needs of the student and the general practitioner. It achieves a remarkable clearness and simplicity, considering the complex subject matter. Chapter 2, "Interpretation of Neurological Symptoms and Signs," is outstanding. A valuable feature is provided by the admirably organized "tables of differential diagnosis" with which the book is implemented throughout. These too have been carefully brought up to date.

Clinical Interpretation of Laboratory Tests. By Raymond H. Goodale. Philadelphia: F. A. Davis Company, 1949. Pp. 605; 107 illustrations.

Here is a systematic presentation of laboratory tests and technics useful in the diagnosis and treatment of all varieties of pathologic disturbance. Opening with a discussion of normal physiologic values and the significance of various departures therefrom, Dr. Goodale proceeds to describe various clinical and surgical entities and the physiologic abnormalities associated with them, clarifying the problem of diagnosis with many excellent charts and tables in addition to the textual content. Antibiotics and chemotherapy in general are thoroughly treated under the heading "Bacteriologic Examinations." In the section on hematology, the effects of the atom bomb, which somewhat resemble those of overexposure to roentgen rays, are given mention.

Dr. Goodale warns the reader that "although certain tests are pathognomonic, clinicians should not rely entirely upon the laboratory for a diagnosis," since these, although often extremely helpful, "cannot replace a careful history and physical examination."

An Atlas of Amputations. By Donald B. Slocum. St. Louis: The C. V. Mosby Company, 1949. Pp. 562: 564 illustrations.

Factors of practical significance in amputation are the basis of Dr. Slocum's book, whose purpose is "to present to the reader those methods of the past which have stood the test of time and to add to these the fruits of recent experience in surgery, rehabilitation and prosthetics." The main point of emphasis throughout is function, since the author rightly declares that an amputation is not terminated with the closure of the surgical wound but imposes upon the surgeon a responsibility to see that the artificial member is properly selected and fitted and the patient rehabilitated to normal life as far as possible.

There are four main divisions of the material: "Orientation," "Surgical Considerations," "Surgical Techniques" and "Convalescent Period." All are generously illustrated. The final section especially is notable for its encouraging photographs of amputees engaging in nearly all popular sports, such as swimming, diving, golf, bicycling, baseball and tennis. The immense improvement in amputation technics and facilities during the past few years, as emphasized by the recent war, is nowhere better or more vividly presented than in these pages.

Abstracts from Current Literature

Acute Abdominal Emergencies. Thorek, P., J. Mich. State Med. Soc. **48**:189, 1949.

The following outstanding acute surgical abdominal conditions have been observed in a series of surgical cases obtained from Cook County Hospital, Chicago: (1) perforated peptic ulcer; (2) acute appendicitis; (3) acute cholecystitis; (4) renal colic; (5) acute hemorrhagic pancreatitis, and (6) coronary occlusion. These cases cover a ten-year period. Dr. Thorek points out that although a coronary occlusion is not a surgical emergency, its correct diagnosis is of surgical importance. Another disease that should not be forgotten is acute salpingitis.

After a thorough probing of the six aforementioned conditions, the author points out that many other acute abdominal conditions at times require differentiation. Some of these are strangulated hernia, regional ileitis, mesenteric lymphadenitis, mesenteric thrombosis, vasitis, torsion of the omentum, volvulus and intussusception. However, missing one of the rather unusual conditions in this latter group is considered more readily explainable than missing the symptoms of the primary six.

A. H. Letton

Urethral Caruncle. Palmer, J. K.; Emmett, J. L., and McDonald, J. R., Surg., Gynec. & Obst. **87**: 611, 1948.

The authors present an extensive review of the literature concerning the etiology, pathology, classification and treatment of urethral caruncle. Because of the diversity of opinion upon this subject, the conclusion is drawn that there is no definitely known cause and no single treatment of the condition.

The review is excellent. Certain significant facts are brought out; namely, that urethral caruncle is a benign condition of the female urethra that may or may not cause symptoms. Treatment has been both conservative (topical application of caustics or radium and roentgen therapy) and radical. The latter consists of simple fulgaration, simple excision, or removal by electrosurgical knife, loop or urethraplasty. A combination of conservative and radical methods has also been used.

The authors also reviewed 120 cases from the Mayo Clinic, presenting a complete histopathologic and chemical study. It was concluded that regional or circumscribed urethral mucosal prolapse is probably the cause of urethral caruncle, which can explain the varied symptoms; that the anatomic and histologic structure of the female urethra encourages this type of prolapse, and that the varying degrees of trauma and irritation that may occur give rise to a varied microscopic picture.

Urethral caruncle is not a neoplasm or a precancerous lesion, but these conditions may coexist, and every caruncle should be examined microscopically to determine its benign or malignant character. All methods of treatment described have a place in the therapy of caruncle but should be considered only palliative, as the rate of recurrence is high and further treatment may be necessary.

David Gomberg

Carcinoma Developing in Chronic Draining Cutaneous Sinuses and Fistulas. McAnally, A. K., and Dockerty, M. G., Surg., Gynec. & Obst. **88**:87, 1949.

The carcinogenic "tendencies" of radiodermatitis, senile keratosis, leukoplakia and other lesions have been stressed for many years. This has led to early diagnosis of carcinoma superimposed upon these lesions, with an excellent prognosis for those treated at an early stage. The literature covering the occurrence of carcinoma in chronic inflammatory sinuses and infected tissues is reviewed.

The clinical material for this paper was obtained from cases observed at the Mayo Clinic, in which malignant changes had taken place in chronic sinuses, fistulas, cutaneous lesions, and chronic osteomyelitic sinuses. There were 9 cases of osteomyelitic sinuses in approximately 4,000 cases (0.23 per cent). There were 3 cases in 3,000 of fistula in ano (0.1 per cent). There was 1 empyemic sinus out of 1,500 cases, (0.07 per cent). There were 11 men and 2 women. The maximum duration of this sinal inflammation was forty-eight years; two years was the minimum, with an average of twenty-six and seven tenths years. There were 6 lesions in the tibia and 1 each in the femur, shoulder, hand and pleural space. Three were fistulae in ano.

The signs and symptoms were gone into in each one of these 13 patients. In 7 of the 9, nodes were involved, and in 2 more they became invaded later, after the lesion was first diagnosed. Syphilis was found in 1 case and pathologic fracture in 2.

In the osteomyelitic group all the lesions were squamous cell epitheliomas, most of them low grade by Broders' method. In the fistula in ano group, 1 was a squamous cell epithelioma and 2 were adenocarcinomas. All 3 were Grade 1 lesions. In the empyemic group 1 was a Grade 2 epithelioma.

Of the osteomyelitic patients, 3 had amputations and 1 of these had postoperative roentgen therapy.

One of these 3 patients lived eleven years and died of gastric carcinoma. Another was alive twenty-one years after the operation, and a third died of chronic nephritis fourteen years postoperatively. One patient died from metastatic lesions three years after a partial amputation. One patient died one year after the operation; the cause of death is not stated. The other patients were alive from four to thirteen years after amputation. One patient could not be traced.

Of the patients with fistula in ano, 2 died within a year after their operations, and the third was living and well three years after excision of this tract. The 1 patient with empyema was lost sight of when he left the hospital two weeks after the operation.

In the author's opinion, too much emphasis has been placed on Cohnheim's theory of chronic irritation as the causative factor in malignant change. They emphasize the low incidence of this complication in the many cases of chronic osteomyelitic sinuses and other draining sinuses studied for many years. These sinuses should be completely excised, or complete or partial amputation should be done as soon as the diagnosis is made. It is proposed that regional lymph nodes should be treated with roentgen therapy, and in some cases a prophylactic dissection of these nodes should be considered. For fistula in ano and empyemic sinus, radical excision is advocated.

E. L. JEWETT

Epinephrine and Histamine in Obliterative Inflammations of Arteries. (O Adrenalinie i Histaminie w Zwezajacych Zapaleniach Tetnic). Nowicki, S., Polski Przeglad Chirurgiczny **21**:21, 1949.

Clinical observation points to the fact that administration of histamine is not constant in inducing an increase in epinephrine secretion. In physiologic states it produces dilatation of arterioles and capillaries. Adrenalin does not affect all vessels to the same degree; some, particularly those in the muscles, it dilates. Vascular contraction may occur also with a low content of epinephrine in the blood. The epinephrine level is not constant; consequently its action cannot result in the well known contraction complex.

The action of histamine on the secretion of epinephrine in cases of obliterative vascular disease is not known. Histamine in the colon, observed in the presence of chronic constipation, does not seem to increase the epinephrine content of the blood. In man, small amounts of histamine given hypodermically dilate the arterioles and capillaries of the extremities. Clinical observation shows that injection of small quantities (3 to 5 mg.) of histamine in many instances of obliterative inflammation of the arteries will increase the circulation, and more frequent doses may improve the circulation of the extremity. This may be confirmed by the skin temperature curve of the foot.

W. F. KALISZ

Chronic Nonspecific Jejunitis. Green, R. B., Navy Med. Bull. **49**:488, 1949.

A review of the literature on chronic enteritis indicates that chronic nonspecific jejunitis occurs with only 5 per cent of the frequency of regional ileitis. Three cases of proved chronic nonspecific jejunitis were studied by the author. On the basis of the data obtained by these studies and that supplied by other authors, he outlines some of the characteristics of this disease.

It is predominantly a disease of young men, although any age group may be affected. The average age of the patients in reported cases is 29½ years. No cases are cited in the literature in which the patients were women. The cause is unknown. Many theories have been presented but none proved. The pathologic picture varies with the duration of the disease. In the early stages the affected jejunum appears hyperemic, dusky and thickened. Varying degrees of lymphadenopathy may be seen in the ajacent mesenteric lymph nodes. All or any portion of the jejunum may be involved. In the late stages obstruction, obliteration of the intestinal lumen or fistula formation may occur.

A history of gradually increasing abdominal pain, nausea, vomiting, diarrhea, lassitude, loss of weight and a low grade fever lasting from one week to several months is often obtained. The pain is usually intermittent and cramping; it is located frequently in the epigastrium, although it may occur in the lower abdominal quadrants. Roentgen examination often shows hypermotility and loss of the "herring-bone" pattern in the region of the jejunum in cases without obstruction. A delay in the passage of barium from the duodenum is noted if obstruction exists in the jejunum. In late stages the "string sign" of Kantor may be evident.

The treatment is surgical. Resection of the diseased segment of jejunum with primary anastomosis, and also duodenojejunostomy after transection of the jejunum below the involved portion, are methods of treatment that have been employed. The author resorted to gastroenterostomy in his 3 cases. All of these methods have apparently given good results.

Follow-up studies have shown the patients whose cases are reported in this paper to be symptom free since operation. It is felt, however, that they may not be cured and that the disease may occur in other segments of bowel. J. O. MORGAN

Cough Fracture of Ribs. Raymond C. Cohen, Brit. Med. J. 1:133, 1949.

This paper calls attention to an infrequent fracture that occurs as a result of coughing. Many of the patients are tuberculous and the fracture probably occurs after violent expiratory effort, as in coughing or sneezing. Women seem to be much more frequently affected than men.

The literature on this topic is scanty, the first mention of the condition being attributed to Halliwell in 1929. The author presents 7 cases, in all of which the patients had tuberculosis. In no case was there any trauma or injury. The upper four or five ribs are the ones least likely to be fractured, because they have less excursion than the others and are supported by more of the scapular musculature.

Primary tuberculous osteitis of the ribs is extremely uncommon and is probably not the basic cause of many of these fractures. However, it is possible that the bone becomes rarefied when it is adjacent to a cold abscess arising from a caseous tuberculous gland. Old age, with its increased osseous fragility, is a definite contributing factor.

Blood calcium and blood phosphorous levels remain constant in patients with pulmonary tuberculosis and hence cannot be a causative factor.

The author expresses the opinion that the most likely mechanism producing this condition is violent and abnormal action of the chest, probably associated with asymmetric posture exerting uneven action on the ribs, occurring during the violent expiratory effort of a cough or a sneeze.

E. L. JEWETT

New Incisions and Revised Technics in Peripheral Nerve Surgery. Seletz, E., Western J. Surg. Obst. & Gynec. **56**:565, 1948.

As the result of studying and repairing 2,037 nerve injuries while in Army service, the author realized that for a successful outcome the following four principles had to be observed: 1. A more direct surgical approach to obtain adequate exposure. 2. Avoidance of injury to other structures. 3. Bridging of extensive gaps. 4. Prevention of contraction scars.

The approach to deep-lying nerves is made through fascial planes rather than by penetration through muscles. If a muscle is to be cut it must be split in the direction of its fibers. When a muscle must be divided, it is severed only at its point of fascial attachment. Cutaneous incisions perpendicular to flexion creases result in a traction scar.

Five incisions are described: (1) cubital approach to the median nerve by a Z incision; (2) popliteal approach to the sciatic nerve at its point of division; (3) lateral approach to the sciatic nerve in the thigh; (4) mesial approach to the tibial nerve, and (5) combined incision of the hand and the wrist for following the median or ulnar narves. The small intact area between the two incisions, consisting of skin, fascia, and transverse carpal ligament, is undermined and the nerve exposed beneath it.

R. N. COOPER

Cystadenoma of the Pancreas. Herrman, C. S., and Asbell, N., Am. J. Surg. **78**:107, 1949.

The authors present 2 cases of cystadenoma of the pancreas, in both of which the tumors were excised intact. They state that the symptoms of this disease are those produced by pressure of the tumor on adjacent viscera, and hence subject to wide variation. Methods of treatment are discussed, the authors expressing preference for total excision. In their opinion these tumors are more common than is generally realized, probably because individual surgeons hesitate to report on their necessarily meagre experience.

HOWARD S. STERN

Needle Biopsy of the Liver in the Diagnosis of "Surgical" Jaundice. Webb, J. P., and Werthammer, S., South. Surg. **15**:393, 1949.

Needle biopsies of the liver have been used in the study and diagnosis of various deseases of the biliary tract. This means of investigation is especially helpful in arriving at the cause of jaundice when other methods have failed. The structure of the liver is such that the material obtained by needle biopsy gives the pathologist sufficient tissue to get an adequate microscopic picture of the various components of the organ.

The authors use a "Vim"-Silverman needle, which is introduced in the midaxillary line at the center of liver dullness to a depth of 2 to 4 cm. in the right lobe of the organ. By this approach the danger of injury to hollow viscera and large vessels is obviated. Hemorrhage is the greatest hazard, although it is rarely severe enough to be serious. Pain occurs in about one-third of the patients and is usually referred to the right shoulder or to the neck.

The histologic differentiation of extrahepatic block from hepatitis is based on microscopic details, which are relatively simple except in late stages. In cases of obstructive jaundice, the ducts become enlarged and filled with inspissated bile and the hepatocellular element tends to be spared. When complete obstruction persists for some time, atrophy of the liver cells occurs and bile ducts become compressed by inflammatory infiltration.

Even in these cases the pathologic change is largely confined to the periportal field and does not invade the lobule until very late. In the presence of hepatitis there is diffuse infiltration of all components of the liver with inflammatory cells. Kinking and disruption of the liver cords is noted, associated with degeneration and necrosis of the cells, and the radial structure is blurred with exudate.

It is felt that extrahepatic obstruction can be diagnosed with certainty from biopsy studies within two or three weeks after the onset of jaundice. Occasionally, after this time, the condition may be hard to differentiate from longstanding hepatitis.

J. O. MORGAN

Vagotomy and the Anatomic Variations in the Vagus Nerve, Boyd, A. K., Am. J. Surg. **78**:4, 1949.

Dr. Boyd has conducted an extremely detailed dissection of the vagus nerve in 50 preserved cadavers, from the bifurcation of the trachea to the incisuria of the stomach. His purpose was to determine whether or not the vagi between those lovels could be separated into definite patterns (1) to determine a level at which the trunks might be fewest and most readily isolated for surgical division and (2) to discover what anatomic variations would make such a transection difficult.

The results were tabulated into six groups of patterns of increasing complexity. The greatest uniformity observed in the stomach. Only rarely did any trunk remain single for a distance of more than 5 cm., and there were anastomoses between the anterior and posterior trunks.

Classification of the pattern of the vagus innervation of the stomach at the esophageal hiatus (50 consecutive cadavers) showed 7 with single anterior and posterior trunks, 4 with 1 anterior and 2 posterior trunks, 13 with 2 anterior and 1 posterior trunks, 7 with 2 anterior and 2 posterior trunks, 10 with 3 or more anterior and 1 posterior trunks and 9 with 3 or more anterior and two or more posterior trunks.

The posterior gastric nerves were more constant than the anterior. The author concludes that vagotomy, which is technically feasible through the abdomen, can be totally accomplished only by stripping the esophagus and the upper part of the stomach of all obvious nerve trunks and adventitious tissues down to the longitudinal muscle layer for a distance of not less than 8 cm.

HOWARD S. STERN

Giant Follicular Lymphoblastoma of the Appendix. Jason, R. S., and Malloy, H. R., Am. J. Surg. **78**:123, 1949.

The authors present a case of lymphoblastoma of the appendix, the tenth to be discussed. In this case the tumor was a nodular swelling in the middle of the appendix, but the lesion may be nodular, pedunculated or diffuse. It is important because the tumor may mimic appendicitis or appendicitis may complicate the tumor. Furthermore, it may become malignant.

The tumor is insidious in onset and may occur at any age. It is at first benign and may remain so and heal, or it may become malignant. The patient appears healthy during the benign phase and at this time the tumor is highly radiosensitive. The lymphoepithelial structures of the digestive system may be involved. Appendectomy while the lesion is localized apparently cures the disease.

HOWARD S. STERN

CORRECTION

Owing to an error in typesetting, a line was omitted from the Acknowledgements appended by Dr. Thomas J. Kirwin to his article "Tumors of the Bladder" in the January issue of the *Journal*. The first sentence of the Acknowledgements should have read as follows:

Dr. James Lisa of the Doctors Hospital and New York City Hospital and Dr. Chandler Foot and Dr. John M. Pearce of the New York Cornell Medical Center supplied the pathologic studies presented here.

Armamentarium

Air Conditioning: Eleven new or completely redesigned air conditioning units for room, apartment, office or suite of offices are presented by Carrier Corporation of Syracuse, New York, as part of its 1950 line. The corporation announces that its distributors and dealers have also been provided with a liberalized retail financial program.

Rectal Irrigator: An instrument designed to eliminate the use of bed pans in the administration of enemas is offered by Woods Professional Supplies of South Gate, California. The device is said to reduce the number of necessary changes of hospital bed linen by eliminating the need of long drainage periods; to permit thorough irrigation and cleansing, and to obviate the need for absorbent cotton padding during drainage. There is no need for the nurse or attendant to lift the patient at any time during the process.

New Sulfonamide Preparation: Sharpe & Dohme of Philadelphia announce the national release of Neotresamide Tablets, a triple sulfonamide combination. The tablets are designed to eliminate the problem of crystalluria (formation of sulfonamide crystals in the urinary tract). They contain sulfamerazine, sulfamethazine and sulfadiazine in the following proportions: 0.1 Gm. sulfamerazine, 0.2 Gm. sulfamethazine and 0.2 Gm. sulfadiazine per 0.5 Gm. tablet.

Dial to Measure Heat Radiation: The Heat-O-Meter Company of New York has placed upon the market a new calculating dial for measuring heat radiation on steam and hot water heating systems. The manufacturer claims that it eliminates the tedious figuring usually necessary to determine the correct amount of radiation and can be used by anyone, without previous technical training. An additional feature of this instrument is that it contains sizes, capacities and minimum and maximum heights on both old and new styles of radiators, mains, returns, risers, chimneys, round and sectional boilers, etc., thus delivering the correct answers to heating problems at the turn of the dial.

New Penicillin Product: Winthrop Stearns, Inc., is now offering Procaine Penicillin G in Oil with 2% Aluminum Monostearate, fortified with Potassium Penicillin G. Crystalline. Each unit contains 400,000 units of penicillin per cubic centimeter and is packaged in vials of 10 cc., sufficient for 10 doses.

Tax Guide for Doctors: The Schering Corporation is issuing a new edition of its guide to preparation of the physician's income tax declaration and return, providing answers to everything from general tax return procedure to such problems as bad debts or the deductibility of reading matter for the physician's waiting room. The "Guide" is being presented to physicians by Schering Professional Service Representatives, as a further service to the medical profession.

New Tape Recorder: The A. E. Aldridge Associates of Philadelphia are introducing a tape recorder that, according to its originators and manufacturers, carries tape recording into a brand new phase of development. Its exclusive features include twin track recording without interruption for rewinding and a "Thread-a-Matic" feaure that simplifies the threading of tape. The volume indicator, an electric eye device, is said to make perfect recording possible every time. Known as "the REELEST," the tape recorder has been made for easy portability and is carried in a streamlined case of simulated leather. The makers suggest that doctors will find it useful in recording laboratory observations, consultations and case histories; interns, in checking patients into the hospital and recording the condition of those already hospitalized.

Compact Autoclave: The "Presto Autoclave," a low-priced portable steam sterilizer for physicians, dentists and research laboratories, uses only plain water in its operation and, it is claimed, makes it possible to sterilize instruments, dressings, gloves, gowns, etc., in a few minutes' time at the lowest possible cost. The autoclave is streamlined for easy cleaning and constructed of aluminum for lightness in weight. It contains a stainless steel sterilizing crate (capacity 915 cubic inches). Only dry steam comes into contact with the contents of the sterilizing crate, which eliminates the possibility of contamination in handling for drying before use. This autoclave is distributed by its manufacturers, the National Pressure Cooker Company of Eau Claire, Wisconsin. It may be ordered either direct from the factory or through the company's representatives.

In Memoriam

GLENN HAROLD HEILMAN

M.D., F.A.C.S., F.I.C.S.

Dr. Glenn Harold Heilman, of Tarentum, Pa., passed away in September 1949. Dr. Heilman was a graduate of the Medical School of the University of Pittsburgh and did his postgraduate work at Harvard. His specialty was surgery, general and industrial. For nineteen years he served on the Senior Surgical Staff of Allegheny Valley Hospital at Tarentum. He was a member of the American Medical Association, the American College of Surgeons and the Allegheny County Medical Society.

NATHAN I. SLUTSKY

M.D., F.I.C.S.

On May 12, 1949, Dr. Nathan I. Slutsky, Brooklyn, N. Y., died at the age of 63. Dr. Slutsky, attending urologist at the Beth Moses Hospital, N. Y., received his medical education at Cornell medical school, and served his internship at the Sydenham hospital, N. Y. Dr. Slutsky was a member of the Society of County of Kings, and the Genito-Urinary Division of the County of Kings.

AUSTIN CHALMER LYNN

M.D., F.A.C.S., F.I.C.S.

December 27, 1949, marked the passing of Dr. Austin Chalmer Lynn of Philipsburg, Pa. Dr. Lynn was graduated from the Medico-Chirurgical College at Philadelphia in 1911. During the years 1917, 1918 and 1919 he served as a surgeon in Evacuation Hospital No. 3, American Expeditionary Force. From 1919 to 1946 he was a member of the surgical staff at Philipsburg State Hospital, serving from the year 1932 as Chief of Staff and Chief of Surgical Staff.

Dr. Lynn's active career was devoted entirely to general surgery. He was a member of the American Medical Associaton and a Life Member and Fellow of the American College of Surgeons. He held membership also in the Clearfield County and Pennsylvania State Medical Societies.

SAMUEL FREDERICK MULLINS

M.D., F.A.C.S., F.I.C.S.

Dr. Samuel Frederick Mullins, of Danbury, Conn., a graduate in 1906 of the University and Bellevue Hospital Medical College (now Medical College of New York University) died recently after thirty-seven years of service as Attending Surgeon and Consulting Surgeon at Danbury Hospital and Southbury Training School.

Dr. Mullins was a past president of the Danbury Medical Society and the Fairfield County Medical Association, and represented Fairfield County on the Connecticut State Council. He was a member of the American Medical Association, the American College of Surgeons, the New York Academy of Medicine, Danbury Medical Society and Connecticut State and County Medical Societies.

PAUL NEWTON JEPSON

M.D., F.A.C.S., F.I.C.S.

Dr. Paul Newton Jepson, of Philadelphia, died on Oct. 24, 1949. A graduate of the University of Pennsylvania Medical School, Dr. Jepson held responsible staff positions in orthopedic surgery at St. Joseph's Hospital, Doctors Hospital, Fitzgerald Mercy Hospital and Phoenixville Hospital and was Associate Professor of Orthopedic Surgery at the University. He has done notable investigative work on Volkmann's contracture and spastic birth palsy.

Dr. Jepson was a member of the American Medical Association, the American College of Surgeons, the American Academy of Orthopedic Surgeons, the Alumni Association of the Mayo Foundation and Pennsylvania State and County Medical Societies.